

SCIENCE

NOVEMBER 23, 1951

VOLUME 114

NUMBER 2969

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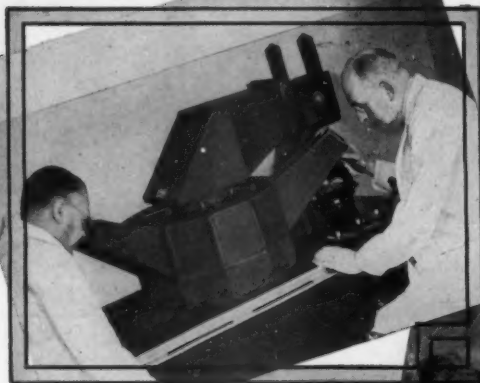
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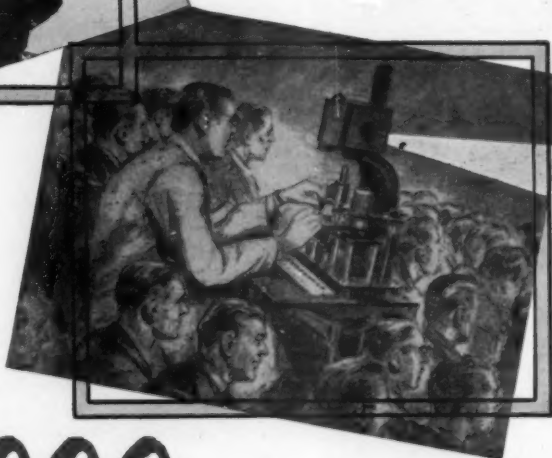


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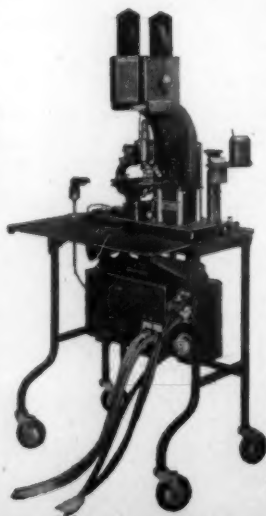
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Sterilization without appreciable temperature rise is what makes the application of cathode rays to sterilization an attractive one and in particular, for use in those cases of temperature sensitive materials. It appears that many types of heat sensitive pharmaceuticals such as antibiotics and hormones can be electron sterilized in their final glass or plastic containers without reduction in potency of the material or other adverse effects.

4th District Branch
Medical Society of the
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TOMORROW'S ENGINEERS: I consider you who work in our offices and laboratories the most important group I can possibly reach . . . I am asking you to make your voices heard by those who are coming up through our schools so that they will not deny themselves the advantages of an engineering career because of the ridiculous belief that engineers are a dime a dozen.

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November–December 1951



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Large Apparatus Division

"BUMPER," TWO-STAGE ROCKET PROGRAM: In an effort to more nearly realize the full advantages of a multi-stage design, in 1946 the Army Ordnance Department decided to embark upon a program of design and development of a two-stage test vehicle of better performance than any vehicle then available.

A co-operative program, called "Bumper," was established. Basic responsibility for the program was assigned to General Electric's Project Hermes.

The vehicles selected were the American WAC Corporal for the second stage, and the German A-4 (V-2) for the first stage.

So far, the Bumper Program has: (1) demonstrated the techniques of launching large two-stage vehicles and of securing separation at high velocities and altitudes; (2) established a new velocity record of 7550 feet per second, or 5150 miles per hour; (3) established a new altitude record of 250 miles above the earth; and (4) demonstrated two-way communication with an object 250 miles above the earth—this being above the D, E, and F layers of the ionosphere.

Electrical Club of
Montreal, Canada
October 24, 1951

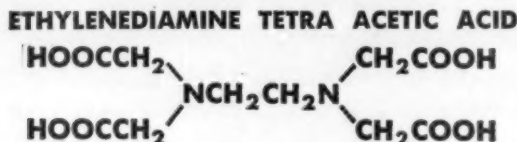
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Conservation of Human Resources

ALTHOUGH Adam Smith postulated that the wealth of a nation depends upon the quantity and quality of its labor supply, only recently have economists recognized the importance of the study of human resources. Throughout the nineteenth century and far into the twentieth economists handicapped themselves by two crippling simplifications: They assumed that the only important forces in the environment were economic, and that individuals were motivated primarily by a desire to increase their wealth.

Toward the end of the 1930s a group at Columbia University began to develop more realistic and valid assumptions about economics and group behavior. From the start this was a cooperative undertaking in which an economist, psychiatrist, sociologist, statistician, and social worker participated. Much time and effort were devoted to the education of the team members, so that the approaches developed represented a true integration of the several disciplines. Our early work concentrated on labor, particularly unemployment. There were three major publications: *Grass on the Slog Heaps: A Story of the Welsh Miners*; *The Unemployed*; *The Labor Leader*. Following firsthand studies of the disorganization brought about by unemployment, attention was directed to the obverse—namely, the significance of work for the individual and for society. We have recently published the first of these studies, *Occupational Choice*.

After the interruption caused by World War II, the program was re-established, but on a broadened base with expanded staff. General Eisenhower, shocked by the waste of manpower uncovered during the war (about two million men were rejected because of mental and emotional deficiencies), considered it a matter of national urgency to study the problem and to seek solutions. He took the leadership in establishing in the Graduate School of Business at Columbia a five-year basic research program, the "Conservation of Human Resources." Financed by con-

tributions from business and foundations, the project enjoys the full support of the Department of Defense, the Veterans Administration, and the Selective Service System, all of which are cooperating by making their records available. Close liaison is also maintained with the trade unions.

The project is nearing the end of its second year. Its basic program has a threefold focus: studies of marginal and ineffective personnel in civilian and military life; an analysis of the problems of talent and superior performance; and a historical investigation into the changing pattern of work in America.

During the coming year we plan to publish *The Uneducated: A Challenge to the Nation*, which will present the results of investigation into the causes of the large-scale illiteracy revealed during World War II and into the broader question of the relation between minimum education and work performance. A short monograph on *Military Manpower Policy* will provide basic data on manpower selection and utilization in periods of partial and full mobilization. Also nearing completion is a monograph on *What Labor Expects from Government*, which represents one aspect of a more comprehensive study of *The American Worker, 1890-1950*.

We are currently at work on the problem of the ineffective worker and soldier, to clarify the relation between emotional factors and individual and group performance. Within the next few months, work will begin on talent and superior performance.

Three generalizations are suggested by our research: First, basic research in human resources requires a team approach. Second, the research must be underwritten for several years to permit mature planning and careful exploration. Finally, it is feasible to select as a focus for basic research important problems of national policy. This is the framework in which the Conservation of Human Resources Project is cast.

ELI GINZBERG

Conservation of Human Resources Project
Graduate School of Business, Columbia University

SCIENCE, founded in 1880, is published each Friday by the American Association for the Advancement of Science at the Business Press, 10 McGovern Ave., Lancaster, Pa. Entered as second-class matter at the Post Office at Lancaster, Pa., January 13, 1948, under the Act of March 3, 1879. Acceptance for mailing at the special rate postage provided for in the Act of February 28, 1935, embodied in Paragraph (d-2) Section 34.40 P. L. & R. of 1948.

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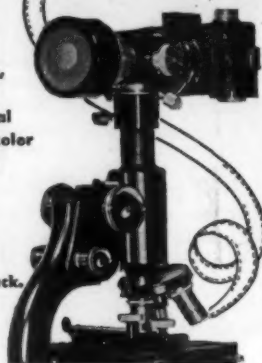
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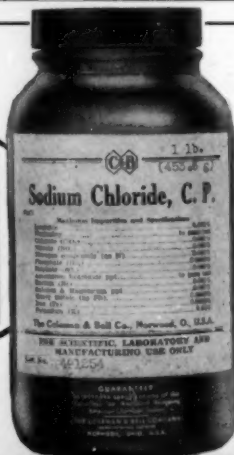
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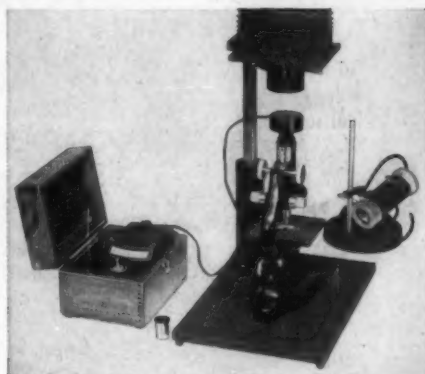
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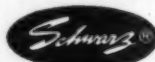
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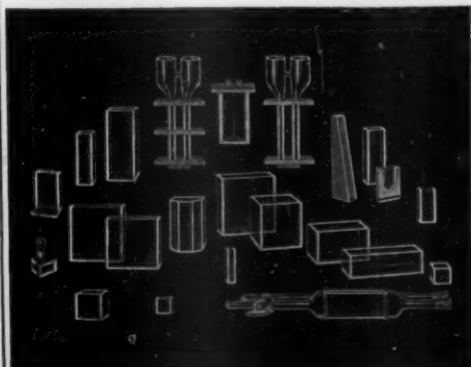
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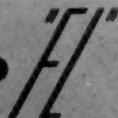
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High Altitude Observatory of Harvard University and the University of Colorado, Boulder

SOLAR FLARES seem possessed of a peculiar and fascinating perversity. The more we learn about them, the harder they are to understand, and the sharper the appetite for more information becomes. Briefly, a flare is a small area in the solar chromosphere in which several lines of the solar spectrum suddenly flash out in emission. Although the H α line of hydrogen and the H and K lines of ionized calcium are the brightest, the emission is usually not quite sufficient to fill in completely their normal Fraunhofer absorption contours. Thus, the total light output constitutes a very tiny enhancement of the normal brightness of the solar surface, and the flares are quite invisible without special instruments. Typical flares rise to maximum brightness in a few minutes and then gradually die out over a period of half an hour or so. They occur in or near sunspot groups and are comparable with the spots in size. Small flares are the most numerous, and the frequency diminishes steadily with increasing area. They appear at a rate that varies with the sunspot cycle and runs at about one every eight hours in our present mid-position on the downward curve.

In spite of their feeble light emission, the flares are apparently very powerful sources of far ultraviolet and corpuscular radiations, which are strong enough to produce large-scale changes in the terrestrial ionosphere at a distance of 1.5×10^7 km. They also emit radio noise with an intensity 10^4 times that of the normal sun at some frequencies, and of certain components of cosmic rays. The reconciliation of the small light output of flares with the obviously enormous output of other forms of energy is a major theoretical problem.

At present we lack quantitative statistical information on the simple flare characteristics of brightness, size, and position, and on their association with geophysical phenomena. The data we have comes almost entirely from the valiant efforts of a group of visual observers all over the world, working cooperatively through the International Astronomical Union to keep the sun under constant surveillance for the detection of flares and for estimates of their characteristics. This effort is immensely worth while and has led to important results. However, visual observation of such rapidly changing objects has troublesome shortcomings,

not the least of which is the requirement that the observer must endure many hours of tedium for the brief excitement of each flare discovery. The estimates simply classify the flares into four groups of "importance," a combination of area and brightness. Systematic personal differences between the estimates of individual observers introduce decided inhomogeneities into even this rough classification.

The Mount Wilson Observatory has run an automatic flare camera since 1936, photographically recording the sun in the light of the K line with a spectroheliograph at intervals of three to five minutes. The flare discoveries from this program, like those of the visual observers, are published by the I.A.U. in terms of time, position, and importance.

As a first step toward improving the statistical data, the High Altitude Observatory, with the Harvard College Observatory, has initiated a photographic flare patrol. The entire disk of the sun is recorded in the light of H α on 35-mm film at intervals of one minute whenever the sun is shining. This one instrument does not, of course, achieve anything like complete coverage, because of cloudy weather and nighttime interruptions. Five or six such instruments distributed fairly evenly in longitude would probably be required to detect substantially all the flares on the visible hemisphere of the sun above the detection threshold. R. G. Giovanelli, of the Commonwealth Scientific and Industrial Research Organization at Sydney, Australia, is constructing a second photographic flare recorder, which will be located in a very favorable longitude relation to our own. It is to be hoped that others will join this effort.

Although invisible in a simple telescope, the flares can be observed with a monochromator that transmits a very narrow band of the spectrum centered on one of their emission lines. The solar continuum is thus eliminated, and the flares and other features of the chromosphere stand out in brilliant contrast. Traditionally, the spectroheliograph and spectrohelioscope have been used for this purpose. They are scanning monochromators, which build up an image, slit-width by slit-width, on a photographic plate or (by very rapid scanning) in an eyepiece for visual observation. In 1942, however, a birefringent filter built by the author was installed in the coronagraph at the Climax, Colorado, station of the High Altitude Observatory (of the Harvard College Observatory, at the time) for

¹ The research reported in this paper has been sponsored by the Geophysics Research Division of the Air Force Cambridge Research Center under contracts W19-122ac-17.

making motion pictures of prominences. They, like the flares, can be observed only with the aid of some form of monochromator. The resulting photographs were of the highest quality, both in definition and in contrast. Since the birefringent filter is very much simpler, more compact, and less expensive than the spectroheliograph, it is gradually coming into more general use for solar observation, and we decided to use it in the flare recorder. Because it is the most vital single element, a brief description of its characteristics is necessary. For a full discussion of the birefringent filter the reader is referred to the literature (1, 2).

In its simplest form the birefringent filter consists of a multiple sandwich with alternate layers of Polaroid film and plates of some birefringent crystal. Quartz, calcite, and ammonium dihydrogen phosphate (abbreviated ADH hereafter) have been used successfully. The crystal plates are cut with their optic axes parallel to the surfaces and mounted with the axes at 45° to the vibration planes of the polarizers (which are all parallel). In traversing a crystal layer the ordinary and extraordinary waves travel at different velocities, and, on emerging, they interfere. The transmission of a single crystal mounted thus between polarizers is

$$\tau = \cos^2 \pi n,$$

where

$$n = \frac{d}{\lambda} \mu.$$

Here τ is the transmission, d the thickness of the crystal plate, μ the difference between the ordinary and extraordinary refractive indices, and λ the wavelength.

Neglecting the comparatively slight variation of μ with wavelength, we find that τ is a periodic function of the wavelength. Let curve (a) of Fig. 1 represent the transmission of the thickest element of a birefringent filter over a short length of spectrum. The second element is half as thick and has transmission

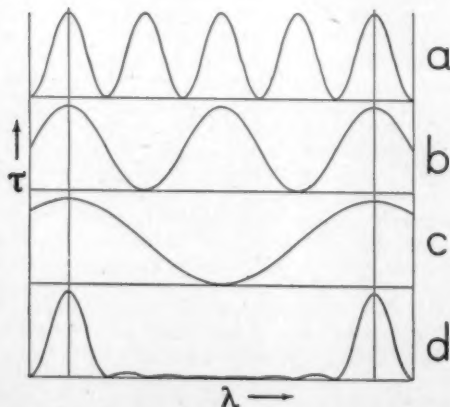


FIG. 1. Transmission curves of birefringent elements.

curve (b). The third element is again half as thick, with transmission curve (c). The combined transmission of the three elements is

$$\tau = \cos^2 \pi n_1, \cos^2 \pi \frac{n_1}{2}, \cos^2 \pi \frac{n_1}{4}.$$

It is represented by curve (d), which is characteristic of the birefringent filter. It consists of a series of sharp transmission bands spaced at wide intervals along the spectrum. The ratio of band separation to effective band width is approximately 2^k in a filter of k birefringent elements. As an example, the Climax filter has six elements of quartz, with thicknesses in powers of $1/2$. The thickest element has $d = 51.381$ mm, and $n = 704$ at H α . The effective width of the transmission band is 4.2 Å with side bands spaced at about 270 Å at each side. The band separation is sufficient to enable us to cut off all the transmission bands of wavelengths shorter than H α by means of a glass filter. The longer wavelength bands are comparatively harmless, since the sensitivity of the eye and of appropriately selected photographic material falls off very sharply in this region. The efficacy of this filter in showing the normally invisible prominences is shown in Fig. 2.

This simple form of monochromator, like any rose, is not without its thorns. The wavelength of the transmission bands is a function of the direction in which light traverses the filter and of the temperature of the birefringent elements.

Let $\lambda(\varphi, \theta)$ be the wavelength of the transmission band for light at an angle φ (in air) to the instrumental axis, in azimuth θ , measured from the crystal optic axis. Then, approximately

$$\delta\lambda = \lambda(\varphi, \theta) - \lambda(0, 0) = \lambda \frac{\varphi^2}{2\omega} \left(\frac{\cos^2 \theta}{\varepsilon} - \frac{\sin^2 \theta}{\omega} \right).$$

Although the filter works equally well in collimated or convergent light, the maximum permissible value of φ is restricted by the maximum tolerable value of $\delta\lambda$. In the Climax filter, $\varphi_{\max} = 0.025$ radian. Since it is placed in convergent light, the beam traversing the filter is limited to $f/20$. Although this is not a severe restriction, it must not be neglected in designing the optical system.

The temperature variation of the wavelength of a transmission band varies widely with the crystal used.

In the neighborhood of H α , $\frac{\Delta\lambda}{\Delta\tau}$ is -0.7 for quartz, -0.4

for calcite, and -7.0 for ADH, in units of Å/degrees centigrade. The temperature of the filter must therefore be controlled. The control of an ADH filter is inherently far more difficult than that of a filter of quartz or calcite.

Another limitation of the simple birefringent filter not shared by the spectroheliograph is that the wavelengths of the transmission bands are fixed, except for the fine adjustment obtained by changing the temperature.

More complicated forms of the birefringent filter are theoretically and practically possible, in which the maximum value of φ is greatly increased, and the

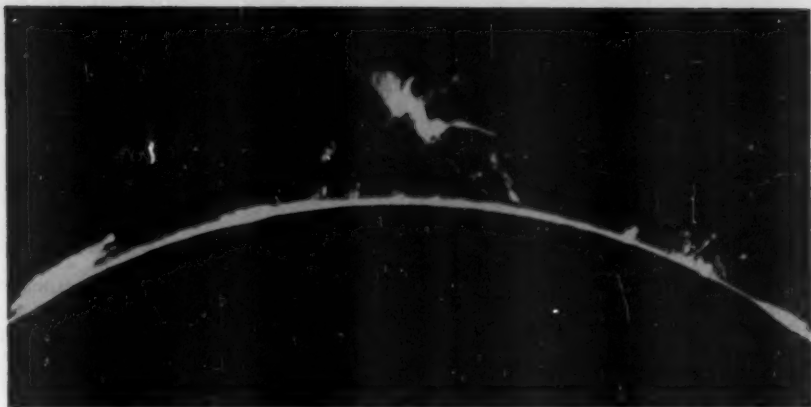


FIG. 2. Solar prominence photographed through a birefringent filter.

wavelengths of the transmission bands can be adjusted to any desired values. Such a filter of quartz and calcite has been designed to be used with the 16-inch coronagraphs now being constructed for the Climax station of the High Altitude Observatory under a contract with the Office of Naval Research, and for the Sacramento Peak station of the Harvard College Observatory, in New Mexico, under a contract with the Geophysics Research Division, Air Force Cambridge Research Center.

Experience with temperature-sensitive ADH filters has led to a general impression that the temperature cannot be controlled with sufficient accuracy to stabilize the wavelength of a really sharp transmission band. The difficulty can be overcome by a thermostat which senses the wavelength directly, instead of sensing the temperature at some point outside the birefringent elements. This device should be especially effective in a filter of adjustable wavelength, since the center of the band can be instantly corrected by the λ control. A control of this type is planned for the large filter mentioned above. In any case the problem is far less acute in quartz and calcite filters than with ADH.

With this rather lengthy introduction, the description of the essentially very simple flare recorder is largely done. The permanent instrument now in operation at Sacramento Peak was preceded by an experimental "breadboard" model built for use in our Boulder, Colorado, laboratory to assess the effectiveness of the birefringent filter for our purpose and to eliminate the inevitable "bugs."

The telescope for the Boulder instrument consists of a polar heliostat mirror feeding an achromatic lens of 16 cm aperture and 300 cm focal length. The light from the lens enters the laboratory through a glass window and is reflected horizontally to the west to form a stationary solar image, 28 mm in diameter. This is followed by a filter and camera unit shown in the diagram of Fig. 3.

Preceding the filter is a field lens with the primary objective at its focal point. Its function is to collimate

light from the entrance aperture. Thus, the axis of the diverging cone originating at each point in the image traverses the filter parallel to the instrumental axis, and the maximum value of ϕ is held to the smallest possible value. It was necessary to restrict ϕ further by placing a 6-cm diaphragm over the objective. A second field lens follows the filter to form an image of the entrance aperture on the camera lens. The camera lens in turn forms a 17-mm image of the sun in the film gate of a modified Fairchild radar recording camera, through a separate rotating-sector shutter from a Mercury Univex camera. The film transport and shutter winding are performed by electric motors actuated in the proper cycle by a timer. The whole arrangement was constructed rather hastily and has given occasional trouble in routine operation.

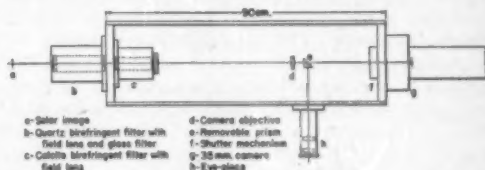


FIG. 3. Optical system of the Boulder experimental flare recorder.

Between the camera lens and shutter is a prism which can be rotated into or out of the beam. When in position, it reflects the solar image into an eyepiece for visual observation between exposures, and a buzzer warns the observer eight seconds before an exposure is due.

The filter is made in two units with independent temperature controls. The first unit is of quartz, 50 mm in aperture. It is a duplicate of the Climax filter, with a 4.2 Å transmission band. Such a band width is nearly optimum for prominence observation, where the ratio between the H α emission and the neighboring continuum is perhaps 100 times as great as that for monochromatic features against the disk of the

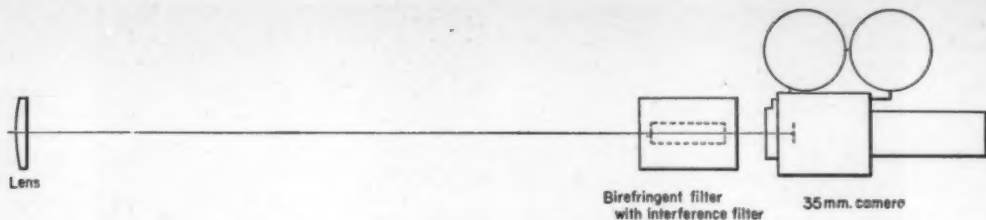


FIG. 1. Diagram of optical system, Sacramento Peak flare recorder.

sun. It is too broad, however, for flare observation. Hence a second calcite filter unit is used to narrow the band further. Calcite has a value of μ 18.8 times that of quartz. Hence the 38 mm of calcite in this filter are equivalent to over 700 mm of quartz. The filter has a single quartz element half the thickness of the thinnest element in the first unit, and three elements of calcite, giving sharp bands 4.2 Å apart. The two thickest elements of calcite are split, and the quartz and remaining calcite elements are sandwiched between the halves of the thicker elements. This is the first operating example of the split element construction (2), which requires only half as many polarizers as the simple filter. The two filter units together transmit a band 0.52 Å wide at H α , with side bands 540 Å on either side.

The temperature of the calcite unit was naturally the most critical, and had to be controlled to about ± 0.1 degree C. This was accomplished by mounting the elements between two thick glass ends in a massive aluminum shell. A thermistor in a well in the aluminum controls the current to a heater wire wound on the shell through an electronic bridge. In the neighborhood of the operating temperature (about 38°) the variation of the heater current is approximately proportional to the temperature deviation. The control has been entirely satisfactory and free of trouble.

Unfortunately, the only calcite available when the filter was constructed was inhomogeneous in birefringence. As a result the calcite unit has appreciable "leaks" outside the principal band, which vary considerably over the field and seriously reduce the contrast of chromospheric features. In spite of this defect, the flares are shown brilliantly, and the preliminary flare recorder was pressed into routine service, monitoring the sun from Boulder for nine months, while the permanent recorder was gestating. During this interval 252 flares were recorded.

The final flare recorder now in operation at Sacramento Peak is notably simpler than the preliminary model. Construction of the eyepiece-shutter-camera complex was completely avoided by the purchase of an Aeme motion-picture camera. This beautiful machine has a built-in reflex mirror to send light into an eyepiece and is designed to take single exposures of widely adjustable duration on impulse from a simple timer. The registration accuracy is of the order of 0.0003 inch.

The original plan was to transfer the two-unit filter

from the "breadboard" to the final instrument. In view of its faulty performance, however, we decided to use a filter of 1.25 Å band width, built commercially by the Baird Associates.

Finally, matters were further simplified by the availability of a stable equatorial mounting at Sacramento Peak, capable of holding the whole instrument. This mounting, which already carried a prominence motion-picture telescope, was explicitly designed to carry simultaneously a variety of solar instruments. It is a rigid 10-foot spar of steel, 12 inches square, mounted equatorially, and accurately guided on the sun by a photoelectrically controlled servomechanism. Mounted on this platform, the flare recorder points directly at the sun, and reflecting surfaces are unnecessary.

Fig. 4 shows the optical system. The objective is a single plano-convex lens of 12 cm aperture and 183 cm focal length. It was made in our optical shop and figured to remove spherical aberration in the red. In use it had to be stopped down to 7 cm to fit the

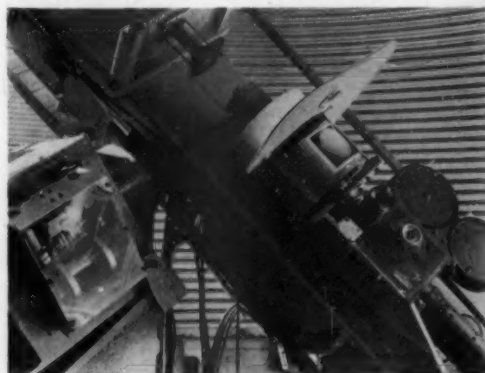


FIG. 5. Photo showing optical system, Sacramento Peak flare recorder.

ϕ -tolerance of the filter. The camera receives the primary image, rather than a secondary image, as in the Boulder instrument. An auxiliary removable lens swings in front of the filter to form an image of a small record plate on the film (Fig. 5). The record plate is simply a sheet of plastic on which observation information (date, time, and state of the sky) can be written. It is placed in a frame between the objective

and the filter and photographed by sunlight. Fig. 6 shows the flare recorder assembled on the 10-foot spar.

In our efforts to simplify the instrument we were only partially successful in evading the law of the conservation of difficulty. We did have a change of diet, however. When the filter was first set up, the transmission band wandered around through several angstroms on either side of $H\alpha$, in spite of the very elegant electronic temperature control. The Baird Associates gave us their vigorous cooperation in tracking down the main source of trouble and reducing the uncontrolled wavelength shifts to a usable value. To a large degree the difficulty lay in a minor detail of construction, which can be simply corrected in future instruments.

The Baird filter is made of crystals of quartz and ADH. It is therefore very sensitive to temperature variations. To provide a small controllable adjustment of the wavelength of the transmission band in the filter, so as to follow radial velocity shifts of various chromospheric features, the thickest ADH elements

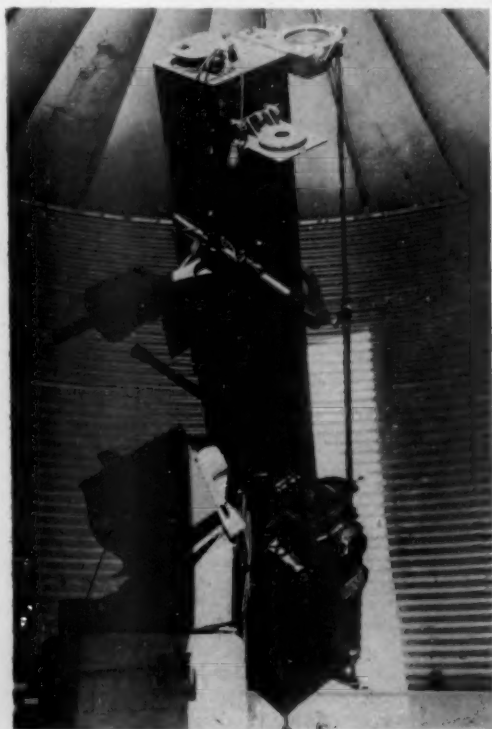


FIG. 6. Sacramento Peak flare recorder mounted on the 10-foot spar.

were mounted with quarter wave plates in rotating rings. Unfortunately, one of these was mounted at the entrance end of the filter, where it received a relatively intense beam of sunlight, without the benefit of the



FIG. 7. Typical solar flare photographed with the flare recorder.

attenuating filter action of the thinner elements. Matters were further complicated by the presence of an absorption band in ADH at 1.5μ . Preceding the birefringent filter is a high-efficiency interference filter for isolating the $H\alpha$ band. This filter, however, is rather transparent at 1.5μ . The electronic control, therefore, was quite unable to cope with the solar heating of this exposed element. The permanent cure is obviously (in hindsight) to mount both rotating elements at the exit end of the filter. However, a fairly satisfactory reduction of the wanderings of the transmission band was achieved by inserting a water cell in front of the filter. Although it still requires an occasional adjustment of the rotating elements to stay centered on $H\alpha$, the filter is giving a good performance and is otherwise an ideal monochromator for our purpose.

The Sacramento Peak flare patrol has been in regular operation since March 1951. By the first of September 252 flares had been recorded. A sample of one of the 35 mm frames with a typical flare is shown in Fig. 7.

The routine of operation of the flare patrol at Boulder and Sacramento Peak is as follows. The recorder runs during each day whenever the sun is free of clouds, taking exposures at one-minute intervals. At the end of the day the film is processed and dries overnight. It is examined for flares the next morning. The position and area of each flare discovered are measured; the brightness is estimated; and the times of discovery, maximum brightness, and ending are noted. This information is sent immediately in a coded telegram to the National Bureau of Standards. There it is used in combination with other data for studies of solar-terrestrial effects.

The most glaring weakness of this program at present is the lack of a quantitative measurement of

flare brightness—perhaps the most important single parameter. Plans are being made for photometric standardization of the films and for measurement with a contour densitometer similar to that described by Babcock (3). A “breadboard” of the densitometer is approaching the try-out stage, but the work goes slowly because of the pressure of other commitments. We do not expect to have any real brightness measurements, therefore, for some months.

The 504 flares observed so far already constitute a small but homogeneous statistical sample, and several

interesting discoveries have emerged from preliminary studies. Space is lacking to discuss them here, but they do justify our efforts in building the flare recorder, and our hope that we may see eventually a whole chain of these instruments stretched around the world to keep a record of all the flares on the visible hemisphere of the sun.

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Technical Papers

Salt Hypertrophy in Succulent Dune Plants

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Early German investigators (1) were the first to recognize that “many plants produce on the shore more succulent leaves than they do when grown inland, while the leaves of *Salsola Kali*, *Halogeton sativus*, and others, are thinner when the plants are grown upon a soil without salt, than is usual on plants growing on saline ground.” Succulence of plants growing on saline soils has been attributed to the absorption of salts by the roots and their subsequent concentration in the mesophyll tissue, resulting in salt-induced hypertrophy (2-4). However, no previous investigation has satisfactorily explained the type of succulence found in dune plants near the strand.

Iva imbricata Walt. exhibits the typical succulent nature of plants found on coastal dunes. The leaves on the windward side of the plants toward the ocean are thick and succulent, whereas those on the leeward side of the same plant are thin, less succulent, and frequently coriaceous. The margins of leaves turned toward the ocean are thicker and more succulent than the leeward margin of the same leaves, and the tips of the leaves are more fleshy than the bases.

Succulence in dune plants has been considered to be a consequence of the more xeric habitat (5), of excessive transpiration (6), and of the salinity of the substratum (7, 8). Salinity of the substratum can be disregarded, since it has been shown that dune sands contain very little soluble salts (9). However, none of these proposals explains why leaves of an individual plant exhibit different degrees of succulence.

Previous studies on the coast have shown that droplets of sea water are ejected into the air by the bursting bubbles of the ocean; that these particles, concentrated by evaporation, are transported inland by winds and deposited on the coastal vegetation; and

that the resultant killing of leaves and twigs by this concentration of salt is responsible for the zonation and spray form of the plants (10-13).

During a study of the coastal vegetation of Brunswick County, N. C., the author investigated the relation of salt spray to succulence. Succulent and non-succulent leaves on the same plant of *Iva* were collected, the surface washed in distilled water, and 5 disks of equal area were punched from each leaf with a small rubber stopper punch. Each group of 5 disks was then macerated and titrated with AgNO_3 for halides. The 5 disks of the succulent leaves contained an average of 16.8 mg of Cl compared with an average of 4.5 mg of Cl in the disks of the nonsucculent leaves. (The titration data are expressed in terms of mg of Cl since the other halides make up such a small part of the salts of the ocean.)

The quantity of salt deposited on the different leaves was estimated with the use of oiled glass slides (14). Slides were exposed for 30 sec at different positions in an *Iva* shrub located on the top of the fore-dunes. The number and diameter of the deposited droplets were immediately determined with a microscope, which was protected from spray by a plastic cover. The average wind velocity from the ocean was 31 km/hr. The slides exposed on the windward side of the shrub caught an average of 1,900 droplets/cm²/min, which averaged 51 μ in diameter. Slides exposed on the leeward side caught an average of 490 droplets/cm²/min, which averaged 22 μ in diameter. Slides exposed at different positions in the shrub caught an intermediate concentration of droplets, both in number and in diameter. Obviously, the leaves on the windward side of the plant are receiving a much higher concentration of salt than the leaves on the leeward side.

Anatomical studies of the succulent and nonsucculent leaves showed a striking difference in the size of the cells. Table 1 shows this difference in *Iva*. The nonchlorenchymous parenchyma showed the greatest swelling, and the chlorenchyma and epidermal cells showed an intermediate swelling. The stomata showed

no swelling at all, and about 60% of them were crushed shut by the swollen epidermal cells. There was no evidence of an increase in the number of cells. The swelling was due entirely to the enlargement of already existing cells.

TABLE 1

COMPARISON OF THE SIZE OF CELLS IN SUCCULENT AND NONSUCCULENT LEAVES OF *Iva*

Tissue	Succulent leaves (μ)	Nonsucculent leaves (μ)
Nonchlorenchymous parenchyma	102 × 262	68 × 82
Chlorenchyma	20 × 150	17 × 65
Epidermis	27 × 65	23 × 34
Stomata	24 × 40	27 × 34

Salt hypertrophy of *Iva* has been reproduced in the laboratory by placing strips of nonsucculent leaves in increasing concentrations of sea water. The concentration of the solution was increased until the cells showed incipient plasmolysis. As the cells regained turgidity, the concentration of the salt solution was increased. After repeating this procedure several times the cells had about doubled in size at the end of 72 hr. It was found that the cells swell more quickly when the sea-water solution is alternated with tap water. At present, no method has been found to induce the cells to return to normal size, though they can be plasmolyzed in saturated salt solutions.

Further investigation has shown that practically all dune species exposed to high concentrations of salt exhibit salt hypertrophy. The change in thickness of the leaves and the relative concentration of salts expressed in mg of Cl of a few representative species is given in Table 2. The succulent and nonsucculent leaves were removed from the same plant at positions of equal light intensity. All the species show the same type of swelling as *Iva*, the nonchlorenchymous parenchyma showing the greatest enlargement, with the chlorenchyma and epidermis showing slight enlargement, and the stomata exhibiting no enlargement. Salt hypertrophy has not been found in the grass species represented by *Uniola*, *Chloris*, *Spartina*, *Triplaris*, and *Andropogon*. However, titration of the leaves of these species showed they contained relatively low concentrations of salt.

Succulence in dune plants, then, is apparently due to the deposition of salt spray on the leaves and branches, resulting in salt-induced hypertrophy of local tissues. Hypertrophy seems to occur only on the leaves and branches on which the salt is deposited. Titrations indicate that after entrance the salts are translocated first to the tips of the leaves, inducing hypertrophy first in the tips, then along the margins, and eventually the entire leaf. There is no indication of the salts being translocated throughout the plant in sufficient concentrations to induce hypertrophy in protected leaves.

Salt hypertrophy is not confined to meristematic tissues but also occurs in leaves that become exposed to salt spray after maturity. Consequently, succulence does not seem to be associated with an influence of salts on the meristematic activities of cells but seems to be the result of salt accumulation in the vacuoles causing an increase in turgor pressure and resulting in the expansion of the cell walls. The primitive nonchlorenchymous parenchyma swell more than the more specialized chlorenchyma and stomatal cells.

TABLE 2

AVERAGE THICKNESS AND RELATIVE CONCENTRATION OF SALT OF A FEW DUNE SPECIES EXHIBITING SALT HYPERTROPHY. SUCCULENT AND NONSUCCULENT LEAVES WERE REMOVED FROM THE SAME PLANT

Species	Succulent leaves		Nonsucculent leaves	
	Thickness (μ)	mg Cl	Thickness (μ)	mg Cl
<i>Iva imbricata</i> Walt.	3,000	16.80	600	4.50
<i>Atriplex arenaria</i> Nutt.	656	5.40	335	1.05
<i>Lippia nodiflora</i> (L.) Michx.	1,900	4.50	656	0.65
<i>Physalis maritima</i> M. A. Curtis	1,200	3.80	248	0.70
<i>Chenopodium Berlandieri</i> Moq.	1,230	3.80	349	0.65
<i>Croton punctatus</i> Jacq.	729	2.60	349	0.80
<i>Ilex vomitoria</i> Ait.	539	1.80	262	0.50
<i>Baccharis halimifolia</i> L.	656	1.60	286	0.45
<i>Quercus virginiana</i> Mill.	102	0.95	68	0.15

Salt hypertrophy is also correlated with the tolerance of species to high salt deposition. The species most tolerant to high salt concentrations have the greatest mass of nonchlorenchymous parenchyma and swell the most when subjected to high concentrations of salt, whereas the less tolerant species have little nonchlorenchymous parenchyma and swell the least. A more complete report of hypertrophy and injury of dune plants induced by high concentrations of salt will be published later.

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Manuscript received Sept. 4, 1951.

Interpretation of Virus-induced Changes in the Shape of Hemagglutination-Inhibition Curves with Egg-White Inhibitor

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The authors have recently presented a hypothesis to account for the striking changes that occur in the shape of the hemagglutination-inhibition curve when egg-white inhibitor is treated with certain active influenza viruses (1-3). The basic postulate of this hypothesis is that inhibitor is inactivated in a progressive rather than all-or-none manner by virus, with a resultant progressive decrease in its affinity for virus. In certain situations (2) the inhibition curve of partially modified inhibitor presented a two-step character, which appeared to necessitate the auxiliary postulate that the virus employed in the titrations was heterogeneous with respect to affinity for modified inhibitor. In this interpretation the plateau which occurred at intermediate levels of inhibition was taken as a measure of the fraction of the total virus which was poorly inhibited. Occasionally, there was observed a dip in the inhibition curve, occurring immediately before the steep terminal rise (2). Because of the usually small magnitude of this effect in relation to the experimental error, no explanation of it was attempted.

Studies now in progress have confirmed thus far the basic notion of a progressive action, but have cut away the foundation for the auxiliary postulate. A slight increase in the precision of measurement, gained through several technical refinements, which

included the substitution of a photoelectric densitometer (modeled after that of Hirst and Pickels [4]) for the visual method of reading previously employed, has enabled us to demonstrate that the dip is a real experimental feature, although it may not always appear. From Fig. 1, which illustrates results of titrations carried out with the densitometer, it is easy to see how a slight loss of precision could lead to the erroneous interpretation of a shallow optimum as a plateau.

In experiments stimulated by these findings, the controllable factors have been manipulated in an effort to delineate the origin and evolution of the phenomena under discussion. The available results point to the optimum and the dip as the consequences of the operation of several processes which differ in direction (for or against hemagglutination) and rate; however, no completely satisfactory explanation has as yet emerged.

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Manuscript received July 2, 1951.

Fundamental Role of the Tone and Resistance to Stretch of the Carotid Sinus Arteries in the Reflex Regulation of Blood Pressure¹

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It has been shown (1) that external local application to the arteries of the carotid sinus areas of epinephrine, norepinephrine or pitressin induces a stimulation of the carotid sinus pressoreceptors and thus a marked and prolonged reflex fall of the systemic arterial pressure and a suppression of the normal hypertensive response to decrease of pressure in the carotid sinus. Local application of drugs such as papaverine or Priscoline provokes, on the contrary, a decrease of stimulation of the carotid sinus pressoreceptors and thus a reflex rise of the systemic arterial pressure. From these experiments it has been concluded that drugs contracting the arterial wall where the pressoreceptors are located stimulate these receptors, whereas drugs relaxing the arterial wall of the carotid sinus induce a decrease of stimulation of the pressoreceptors and thus a decrease of the activity of the carotid sinus nerves which by reflex action moderate the systemic arterial pressure. These experiments also show that the tone and resistance to stretch of the arterial wall where the pressorecep-

¹ This investigation was supported by a grant of the Belgian Foundation for Neuro-Muscular Physiology.

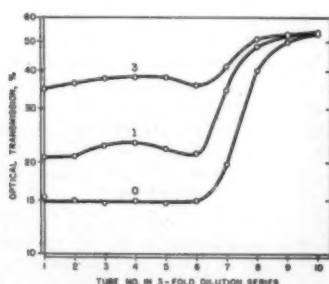


FIG. 1. Hemagglutination-inhibition curves of semipurified egg-white inhibitor after treatment for 0 (control), 1, or 3 hr at 26° C with dialyzed active swine influenza virus in allantoic fluid. The virus-inhibitor mixtures were heated (2 min, 100° C) to destroy the virus and titrated by the method of inhibitor-dilution against 3.5 hemagglutinating doses of heated (30 min, 53° C) virus. A transmission of 15% corresponds to that of a 1% suspension of chicken erythrocytes and denotes complete inhibition of the titrating virus. A transmission of 55% is the maximal value, obtained in the absence of inhibitor. For details of methods, reference is made to previous reports (1, 2).

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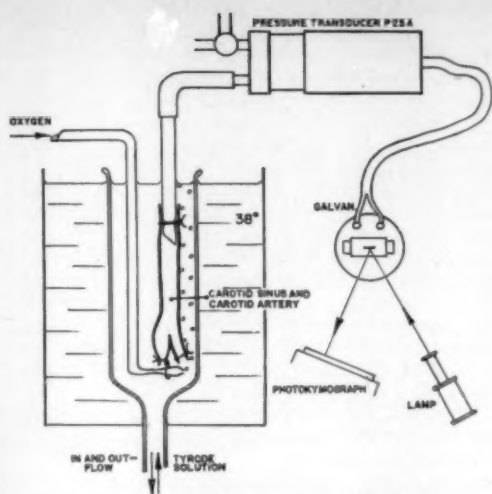


FIG. 1. Arrangement of the measuring technique used in the experiments. The Statham pressure transducer type P 23 A with Control Box CB 7 are used. The galvanometer is the Micromoll Kipp.

tors are located are the fundamental factors for the reflex automatic regulation of the systemic arterial pressure.

Experiments have been performed in order to investigate more directly the action of epinephrine and norepinephrine on the tone of the arterial wall of the carotid sinus area.

The efferent arteries of the carotid sinus are ligated, and the cephalic end of the corresponding common carotid artery is connected with a Statham pressure transducer. The blinded carotid sinus, the segment of common carotid artery, and the pressure transducer are filled with Tyrode solution at an internal pressure of about 10 mm Hg. The internal pressure variations are registered by means of a mirror galvanometer connected with the pressure transducer (Fig. 1).

Solutions of pure 1-epinephrine or 1-norepinephrine bitartrate were applied *in situ* on the carotid sinus area or added to the Tyrode solution in which the carotid sinus preparation was immersed.

As shown in Fig. 2, 1-norepinephrine bitartrate in concentrations of $2 \cdot 10^{-6}$, acting on the arterial wall of the carotid sinus area, induces a rise of intra-

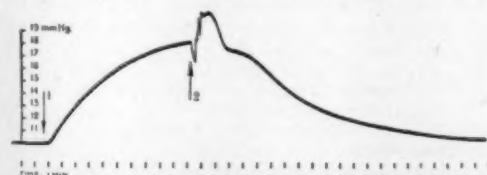


FIG. 2. Registration of the internal pressure recorded during an experiment. The pressure scale represents mm mercury of internal pressure. At 1 addition of 1-norepinephrine, in concentration $2 \cdot 10^{-6}$ followed by a rise of internal pressure. At 2 washing out with Tyrode solution, and return to previous levels of the internal pressure.

carotid sinus pressure up to 8-10 mm Hg. After removal of the norepinephrine, the internal pressure returns progressively to previous levels. The same observations have been made with 1-epinephrine.

These experiments show that 1-norepinephrine and 1-epinephrine applied to the carotid sinus induce a contraction of the arterial wall of this area. This contraction of the arterial wall provokes the stimulation of the carotid sinus pressoreceptors and thus the reflex fall of the systemic arterial pressure observed in previous experiments (1).

These findings emphasize the fundamental importance of the tone and resistance to stretch (distensibility) of the arterial wall of the carotid sinus in the reflex automatic regulation of blood pressure.

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The Red Cloud Sand and Gravel, a New Pleistocene Formation in Nebraska

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Recent studies of the stratigraphy and paleontology of the Pleistocene of Nebraska have resulted in additional data that require further clarification and partial revision of the Grand Island sand and gravel formation (1, 2) in order that there may be no confusion as the result of varying usage of the term.

Lugen's type locality of the Grand Island formation is situated southeast of Grand Island, Nebraska, in the lower slopes of the bluffs of the Platte River Valley, where it is overlain conformably by the silts of the Sappa formation (3)—equal to Upland as formerly used by Lugn (1)—with a comparatively transitional contact. Only the upper part of the sand and gravel sequence is exposed above valley level, however. Lugn included in the Grand Island all the sand and gravel between the Sappa above and the Fullerton silts below, in part exposed at the type locality and in part encountered in test holes in the Platte River Valley to the northwest. The Grand Island was classified as essentially a time equivalent to the Kansan till of the glaciated area. Lugn (1) also correlated as uppermost Grand Island the sands and gravels in northeastern Seward County which rest above a comparatively thin Kansan till and are overlain by the Sappa formation.

Condra, Reed, and Gordon (4), as a result of extensive subsurface studies, continued the usage of Grand Island according to Lugn's conception and applied the name early Kansan sand and gravel to post-Aftonian sands and gravels deposited ahead of the

advancing Kansan ice sheet and overridden by the Kansan ice in eastern Nebraska.

Test drilling indicated that the early Kansan sand and gravel could be traced westward into the lower part of Lugn's Grand Island of the basin area in the type locality, and that the upper part of the Grand Island of Lugn could be traced eastward into the glacial section, where it rested on eroded Kansan till in the areas marginal to the periglacial region. Similar deposits were found to be widely distributed farther northeastward well within the Kansan till area in channels cut deeply into Kansan till where the channels were closely associated with the present major valley systems. Therefore Condra and Reed (3), in their revision of the paper by Condra, Reed, and Gordon (4), applied the names "Upper" and "Lower Grand Island" rather than restrict Grand Island and add a new name or perhaps two new names in the glacial section. Frye, Swineford, and Leonard of the Kansas Geological Survey (5) have used Grand Island in a restricted sense to apply only to the upper part of the Grand Island of Lugn.

Barbour, Schultz, and Stout, paleontologists at the University of Nebraska State Museum (6-8), have recognized for some time that the fossil vertebrates associated with the "Upper Grand Island" deposits of Condra and Reed (3) were closely related to those of the Sappa. More recently Schultz, Lueninghoener, and Frankforter (9) indicated that the fauna from gravels ("Lower Grand Island") in the vicinity of Red Cloud, Nebraska, was clearly distinct from the "Upper Grand Island" fauna in the same general region of south-central Nebraska, thus strongly suggesting that the advance of the Kansan ice sheet had a profound influence on the vertebrate fauna of the region. Moreover, it is evident that the fossil vertebrates from the "Lower Grand Island" are much more closely related to the early Pleistocene (Broadwater and Fullerton) forms than to those of the "Upper Grand Island."

Stratigraphic and physiographic studies made by the staffs of the Nebraska State Geological Survey and the University of Nebraska State Museum indicate that the upper and lower parts of the Grand Island as defined by Lugn occur in normal stratigraphic succession (younger above and on older below) in the basin areas where the Grand Island is only partially exposed. However, in the areas west and south of the east-central Nebraska Basin, along the North Platte Valley in the vicinity of Broadwater and along the lower stretches of the Republican Valley in south-central Nebraska, the "Upper" and "Lower Grand Island" occur in physiographic succession. That is, the "Lower Grand Island" with its typical fauna is exposed as comparatively high-level, valley-side, terrace deposits that are usually mantled unconformably with an upland phase of the Sappa silt formation, whereas the "Upper Grand Island" with its typical fauna occurs as a comparatively low-level channel deposit in a terrace-fill—Terrace-4 of Schultz, Lueninghoener, and Frankforter (9, 10)—mantled conformably by the alluvial phase of the Sappa silt formation. The Pear-

lette ash occurs locally in both phases of the Sappa.

In view of the physiographic, paleontologic, and stratigraphic evidence we conclude that (1) the widespread advance of the thick Kansan ice sheet had a profound effect on the fauna of the region, resulting in a radical change in genera and species of vertebrates; (2) that the thick mantle of Kansan till deposited in eastern Nebraska completely deranged pre-existing drainage and that an essentially new drainage pattern developed with late Kansan glacial retreat; (3) that sedimentation was most active in the periglacial regions at the times of glacial advance and glacial retreat; and (4) that the stream valleys more distant from the Kansan ice sheet, or so located that the Kansan ice neither restricted nor dammed them, tended to be overdeepened and filled at lower levels at the time that larger amounts of water and sediment were again available during the Kansan ice retreat.

Thus it is indicated that the Kansan glacial history of Nebraska and surrounding states is somewhat more complex than was formerly thought. Under these conditions and in the light of the paleontologic differences, it no longer suffices to include all the sediments in one formation, as first suggested by Lugn (1). Moreover, the expedient of dividing Grand Island into "Upper" and "Lower Grand Island" as suggested by Condra and Reed is inadequate and has been widely criticized. Thus it is herein proposed that the name Grand Island be restricted to the "Upper Grand Island," and the name Red Cloud sand and gravel be applied to the "Lower Grand Island" of Condra and Reed, which includes the pro-Kansan sand and gravel. The Red Cloud sand and gravel formation thus was deposited while the Kansan ice sheet was advancing; and the redefined Grand Island sand and gravel formation, during the retreat and waning of the Kansan ice sheet (late Kansan) and early Yarmouth (Sappa) time.

The Red Cloud sand and gravel of the periglacial region appears to be equal in age, at least in part, to the pro-Kansan sand and silt (Atehison formation) in the glaciated area of eastern Kansas (11) and Nebraska. Paleontological studies by Frankforter (12) in eastern Nebraska indicate that the vertebrate fossils from pro-Kansan sand and gravel are similar to those found in the Red Cloud formation in south-central Nebraska.

The type locality of the Red Cloud sand and gravel is located in Red Cloud Township 21½ miles west-northwest of Red Cloud in E ½, sec 28, T 2 N, R 11 W, Webster County, Nebraska. The section exposed at the type locality is as follows:

1. Covered interval to hilltop east of pit 18 ft; probably represents thin Peorian and remnants of Loveland.
2. Sappa silty clay, present locally as remnants preserved in depressional areas on pre-existing surface; thickness 1-4 ft.
3. Red Cloud sand and gravel (new name), grades from sand to medium coarse gravel, gray in color throughout except for upper few feet which is strongly weathered to a yellowish-brown, indicating a profile of weathering and unconformity at its top; thickness 33 ft exposed in sand and gravel pit.

4. Niobrara formation (Cretaceous) chalky shale, erosional top; 32 ft exposed above terrace level along east side Indian Creek.

The Nebraska Geological Survey, the University of Nebraska State Museum, and the Department of Geology at the University of Nebraska have approved the foregoing restriction of the term Grand Island and the adoption of the new name Red Cloud sand and gravel, and these names will be used in future Nebraska publications as herein defined. It may be necessary to apply the hyphenated term Red Cloud-Grand Island to some subsurface intervals in the Pleistocene basin areas where the two formations cannot be separated satisfactorily. However, the subsurface studies of the Nebraska Geological Survey indicate that the Red Cloud-Grand Island interval in many test holes can be separated into a lower sand and gravel grading from coarse-textured at the base to fine-textured above, overlain by a higher sand and gravel with similar textural characteristics.

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Apparatus for the Culture of Bacteria in Cellophane Tubes

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Highly potent botulinum toxin has been produced by Wentzel and Sterne, who grew *Cl. botulinum* in cellophane bags immersed in corn-steep liquor (1).

In a previous publication (2), we have shown the possibility of obtaining high-titer tetanus toxin with the above-mentioned technique but using a different medium. During the course of this investigation, we were led to increase the ratio: cellophane surface/vol of medium; the result of our attempts is evident in the apparatus shown in Fig. 1, which can be described as follows:

A 4-ft length of 64-mm diam Pyrex tubing is fitted at both ends with flared openings for No. 9 rubber stoppers; two side outlets for 1/4-in. rubber tubing

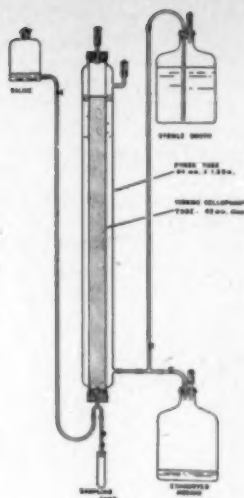


FIG. 1.

are also provided at the two ends of the glass tube.

Into this glass tube is fitted a 42-mm diameter Visking cellophane tubing with the ends intussuscepted over the flared openings of the glass tube, which is now fitted with one-holed rubber stoppers. One of these (which is called the bottom) receives a Y-tube for supplying the inner tube with saline. The other stopper (top) is fitted with an air filter (funnel type).

Rubber tubing connects one end of the Y-tube to a 2-liter bottle filled with saline; the other outlet of the Y-tube is fitted with a device for aseptic sampling.

Similar rubber tubing is used to connect one branch of a T-tube on the lower side of the outside (glass) tube to a 12-liter bottle containing the fresh culture medium. The other outlet of the T-tube is also equipped with a 12-liter bottle for collecting the exhausted medium.

The upper side outlet of the outside glass tube receives an air filter. All rubber-to-glass connections are wired.

The whole apparatus is sterilized in a 6-ft long autoclave for 1 hr at 120° C.

After sterilization the apparatus is hung from the ceiling in an incubator room. Seed culture is introduced into the cellophane tube through the lower Y-tube bringing the saline. The culture medium is then introduced outside the cellophane by means of the lower side outlet.

Bacterial growth is initiated in the saline-dialysate mixture in 24-48 hr, whereas the outside medium remains clear and free from those metabolic products which cannot dialyze—e.g., tetanus toxin. Should the otherwise clear medium become cloudy, one suspects either contamination or a defect in the cellophane. (These can, however, be detected in advance by filling with water before setting up.)

Periodic replacement with fresh broth of the more

or less exhausted medium outside the cellophane tube supplies the bacterial culture with a constantly-renewed supply of nutritive substances as well as removes some of the dialyzable metabolic products which might restrain growth. Thus much heavier growths are obtained than in the usual bottle or flask cultures.

It was soon realized that this apparatus has several other advantages:

1. From the practical point of view, the possibility of renewing the exhausted medium constantly as well as removing periodically part of the bacterial culture, induces us to envisage the production of bacterial cells and bacterial products (toxins, enzymes, etc.) by a continuous process.

2. From the theoretical point of view, the possibility of sampling periodically the contents of both the inner and outer tubes permits us to follow chemically and immunologically the processes concerned with this particular bacterial metabolism.

In a subsequent note, we hope to establish that the heavy growths obtained in this new method result from an extended multiplication phase of the bacterial culture.

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Manuscript received July 2, 1951.

An Improved Iodine-staining Technique for Routine Laboratory Diagnosis of Intestinal Protozoa¹

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An exceedingly simple and rapid iodine-staining technique has been devised by which trophozoites as well as cysts of intestinal protozoa may be stained. For routine identification, the method appears to be an improvement over currently used techniques, including hematoxylin procedures.

An "MIF" solution, so designated because of the presence of merthiolate, iodine, and formaldehyde, is made up as follows:

.10 ml Lugol's iodine solution (Merek Index)	10 parts
.15 " Formaldehyde (USP)	15 "
.75 " Tincture merthiolate 1:1000 (Lilly)	75 "

The mixture is placed in a standard Kahn tube and is ready for use immediately. The 1-ml amount is sufficient to fix and stain 20-25 stool preparations. For consistently good results the tube should be stoppered when not in use, and the solution should be discarded after standing for 6-8 hr.

The stain is used as follows: On one end of a glass microslide the usual unstained smear is made by mix-

¹ A preliminary report.

ing a small amount of freshly passed feces in a drop of normal saline. On the other end of the same slide is placed a drop of distilled water (half the size of the saline drop used for the unstained smear), and to this a drop of equal size of MIF fixing and staining solution is added. About twice as much feces as that used in the simple saline smear should be very thoroughly mixed in the second preparation. Cover slips are placed over both preparations. The total size of either drop should just suffice to fill the under surface of the cover slip, for films that are too thick are unnecessarily difficult to study. The usual microscopic examination of the saline smear is then made, followed by examination of the stained-fixed preparation for nuclear and cytoplasmic detail such as one seeks in iron-hematoxylin mounts. A blue light filter is useful to enhance differentiation of cytoplasmic and nuclear detail.

Fixation of the various species of amebic trophozoites occurs without observable damage and without the loss of organisms that so frequently happens in iron-hematoxylin preparations. Often pseudopodia are seen fixed in extended position. Staining of nuclear and cytoplasmic details in trophozoites of freshly passed stool specimens is of good diagnostic quality. The cytoplasm immediately becomes differentiated, usually first taking a yellowish coloration, which then changes to salmon pink. Nuclear elements stand out in contrast, taking a brownish to almost jet-black stain. Often granules of the nuclear ring are individually defined. Organisms from cases of amebic dysentery stain particularly well, showing ingested red blood cells more readily identifiable than in fresh living unstained preparations.

The above results have held for trophozoites of all human species of amebae, including limited observations on *Dientamoeba fragilis*. With trophozoites of flagellates, cellular morphology and nuclear elements are well demonstrated. Individual flagellae are usually readily identifiable.

The color sequence of the cytoplasmic staining reaction (unstained-yellow-pink) of cysts of amebae or flagellates is slower and more variable in final coloration than is the case with trophozoites. The cyst cytoplasm (especially *Endamoeba coli*) may even remain unstained, but generally assumes an iodine-yellow stain and finally a salmon pink as seen with trophozoite forms. However, regardless of variability of cytoplasmic staining reaction in cysts, the important diagnostic nuclear elements, chromatoidal bars, glycogen vacuoles, etc., are of a definition which permits immediate specific identification.

Variations in trophozoite- and cyst-staining occur between individual organisms as well as between species. This is apparently due to inherent differences in permeability. The formula is designed, however, to cover the usual range of permeability differences. Should a greater nicety of differentiation be desired, the iodine may be increased to 12.5 or 15 parts with a proportionate decrease in merthiolate content. Although this is not frequently required for routine

diagnostic purposes, initial observations should employ trials at the three iodine strengths to demonstrate the full potentialities of the procedure.

Certain precautions must be observed. Fresh Lugol's solution should be prepared weekly, and the MIF formula should be discarded after 6-8 hr usage. To date general staining failures have invariably been due to failure to observe these two precautions. It should also be emphasized that individual degenerate organisms occur in all stools, and in increasing numbers when stools are not examined promptly after passage. Such organisms will not take an acceptable stain with this technique or with any other staining procedure. Freshness of the stool specimen is therefore all-important for good results.

Influence of Testosterone on Nucleic Acid Phosphorus of Rat Seminal Vesicle

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Few data exist in the literature on the nucleic acid content of hormone-controlled organs (1, 2). None are found on androgen effects on male accessory reproductive organs. In this paper we wish to report the effect of testosterone propionate on the nucleic acid phosphorus content of rat seminal vesicles.

sterone administration, as described by Moore and co-workers (3).

Animals were killed by a blow on the head, both seminal vesicles weighed on a torsion balance, and homogenized with distilled water in a glass homogenizer. Ribonucleic acid phosphorus (RNAP) and deoxyribonucleic acid phosphorus (DNAP) were determined in 0.8-ml aliquots of 2% homogenates by Schmidt and Tannhäuser's method (4), as modified by Davidson *et al.* (5). Phosphorus determinations were performed, according to Pereira (6), with some modifications. Reproducibility of the method used was tested, and variation coefficients around 3.5% for DNAP and 5.0% for RNAP were obtained.

Significance of differences between the means of the three groups was studied by the *F* test (7), and that of pairs of means by the *t* test (8). Values of *F* and *t* corresponding to probabilities of 0.01 or less were considered as indicating statistically significant differences between the means.

Data obtained are presented in Table 1. *F* tests on data of each of columns 2, 3, and 4 showed that they are samples of different populations; *t* tests for pairs of means of each of columns 2, 3, and 4 indicated statistically significant differences, except for the DNAP means for groups I and III (*P* > 0.2). These results cannot be due to modifications in the water content of the seminal vesicles, as the ratio dry wt/wet wt was found to be similar for the three groups.

The greater DNAP content of seminal vesicles of group II (castrated) animals as compared with those

TABLE 1
NUCLEIC ACID PHOSPHORUS CONTENT OF CONTROL, CASTRATED, AND CASTRATED
TESTOSTERONE-INJECTED RAT SEMINAL VESICLES

Group	Col 1	Col 2	Col 3	Col 4
	Mean wt of seminal vesicles (range)	Mean DNAP* content (range)	Mean RNAP* content (range)	Mean RNAP/DNAP ratio (range)
I Control (7 rats)	220 (130-320)	25.4 ± 2.45† (16.7-31.4)	48.5 ± 14.15† (29.0-71.7)	1.94 ± 0.51† (1.07-2.45)
II Castrated (8 rats)	96 (48-209)	46.9 ± 8.22 (35.1-61.0)	25.4 ± 2.90 (21.6-30.2)	0.55 ± 0.08 (0.44-0.65)
III Castrated and injected	380 (292-461)	29.3 ± 1.78 (21.1-36.1)	77.2 ± 9.45 (65.2-87.6)	2.67 ± 0.25 (2.34-3.09)

* Micrograms/100 mg fresh weight.

† Standard deviation.

Rats with a mean weight of 220 g (range 150-280 g) were used. The animals were divided into three groups. Group I consisted of control rats, group II of rats castrated 8 days previously, and group III of castrated rats which, after 8 days, were injected with four 5-mg doses of testosterone propionate in oil on alternate days, and sacrificed on the ninth following day.

Histological study demonstrated that castration produced an intense cell atrophy, reversed by testos-

terone administration, as described by Moore and co-workers (3). Animals were killed by a blow on the head, both seminal vesicles weighed on a torsion balance, and homogenized with distilled water in a glass homogenizer. Ribonucleic acid phosphorus (RNAP) and deoxyribonucleic acid phosphorus (DNAP) were determined in 0.8-ml aliquots of 2% homogenates by Schmidt and Tannhäuser's method (4), as modified by Davidson *et al.* (5). Phosphorus determinations were performed, according to Pereira (6), with some modifications. Reproducibility of the method used was tested, and variation coefficients around 3.5% for DNAP and 5.0% for RNAP were obtained. Significance of differences between the means of the three groups was studied by the *F* test (7), and that of pairs of means by the *t* test (8). Values of *F* and *t* corresponding to probabilities of 0.01 or less were considered as indicating statistically significant differences between the means. Data obtained are presented in Table 1. *F* tests on data of each of columns 2, 3, and 4 showed that they are samples of different populations; *t* tests for pairs of means of each of columns 2, 3, and 4 indicated statistically significant differences, except for the DNAP means for groups I and III (*P* > 0.2). These results cannot be due to modifications in the water content of the seminal vesicles, as the ratio dry wt/wet wt was found to be similar for the three groups. The greater DNAP content of seminal vesicles of group II (castrated) animals as compared with those

¹ The authors are grateful to Ciba S. A. for the testosterone propionate ("Perandren") used.

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A New Concept of the Pathogenesis of Ulcerative Colitis¹

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Although much has been written of the pathologic changes in the large bowel of patients with ulcerative colitis, little evidence of the specificity of the lesion has been presented to date. The purpose of this paper is to describe certain distinct changes in the connective tissue of the colon which appear to be of fundamental importance in the pathogenesis of the disease. We suspect that ulcerative colitis falls into that group referred to as collagen disease.

Biopsy material taken during proctoscopic examination from a series of patients, both normal and with ulcerative lesions of the bowel, were frozen, dried, and mounted according to the method described by Gersh and Catchpole (1). The tissue was then treated with leukofuchsin after exposure to periodic acid, as described by Hotchkiss (2), except that care was taken to adjust the periodate leukofuchsin and wash solutions to a pH of 3.5, a modification suggested by Johnson and Permutt (3). Other frozen dried sections were viewed with the phase contrast microscope, thereby eliminating reagents which might alter the morphology. Similar sections were treated with aqueous 0.05% toluidine blue (National Aniline).

Biopsy specimens also were fixed in 10% formalin for hematoxylin eosin and reticulum stains.

The sections of biopsy material from patients with ulcerative colitis revealed a virtual absence of the homogeneous ground substance of the basement membrane of the epithelial cells. The reticulum of the basement membrane was present but was frequently fragmented.

The epithelial cells of the mucosa were morphologically intact, as was the intercellular cement substance, but in many areas the mucosa had separated from the

underlying connective tissue. In the intervening space a homogeneous, Hotchkiss-positive, metachromatic material was observed. Such areas were often free of inflammatory response. Intracellular epithelial polysaccharide in the diseased tissue was dispersed rather than polar. In the lamina propria and submucosa there was an accumulation of homogeneous, Hotchkiss-positive, metachromatic ground substance which proved to be water-soluble.

With phase microscopy (done by Solbert Permutt) the basement membranes are seen as bright areas and are considerably thicker than in those sections treated with reagents (Fig. 1). In the ulcerative colitis epithelium these areas are absent.

The question arises as to whether the changes are merely the result of an inflammatory process regardless of etiology. Gersh and Catchpole (1) have described the disappearance of the basement membrane in rabbitskin after the subcutaneous injection of turpentine. Examination of the bowel of one patient with active amebiasis, in which there was profound inflammation with considerable necrosis, indicated that the basement membranes of the epithelium were intact (Fig. 1, D). A similar finding was noted in a patient with lymphopathia venereum with concomitant colitis. Further studies were made during experimental traumatization of the bowel of a dog with an electrocautery, biopsy specimens being taken during the height of the inflammatory process. The basement membranes remained intact even in areas where the epithelial cells were necrotic.

Last, the examination of a series of sections from ulcerative colitis patients who were responding well to ACTH therapy disclosed areas where the ground substance of basement membrane had returned, although surrounding regions remained free of this structure. The basement membrane was observed in areas where the inflammatory process as indicated by mononuclear infiltration was still quite evident.

The above-described changes in the ground substance of connective tissue of the bowel appear to be of primary importance in the pathogenesis of ulcerative colitis. As alterations in the basement membrane occur, the epithelium sloughs away from the submucosal connective tissue and secondary bacterial invasion results. Warren and Sommers (4), in a detailed study of the pathology of ulcerative colitis, have described two types, one primarily a vasculitis resembling periarteritis nodosa or thromboangitis obliterans, the second and most common variety the crypt abscess type. All our cases fall into this latter group. The crypt abscess form is described as primarily a surface phenomenon, with abscess formation occurring in the lumina of mucosal crypts rupturing through the epithelium into the submucosa. We believe the abscess formation can occur by virtue of the rupturing of the epithelium first, as a result of the changes described in the basement membrane, the epithelium thereby losing its property of barrier.

We suspect that the basement membrane plays a far greater role than maintaining the continuity of

¹ This study was supported in part by the Wallach fund for research in ulcerative colitis and by the Stewart fund.

² The authors would like to thank I. Gersh for his advice and encouragement.

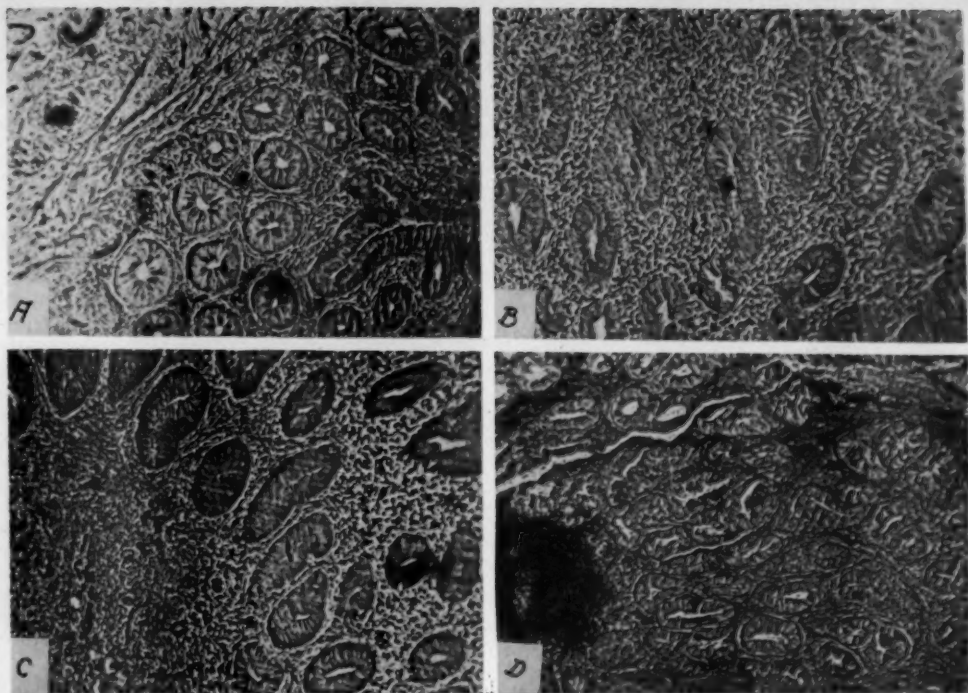


FIG. 1. Sections of human biopsy material. Large bowel under phase contrast microscopy, $\times 100$. Frozen dried material. A, Normal. Note clear areas at base of epithelium, representing homogeneous ground substance of the basement membrane. B, Ulcerative colitis. Note complete absence of the basement membrane. C, Ulcerative colitis treated with ACTH. Note areas of returning basement membrane, although inflammatory process is still evident. D, Amebiasis. Note intact basement membrane in spite of marked inflammation and necrosis.

the epithelium and submucosal connective tissue. Gersh and Catchpole (1) have so clearly pointed out the dynamic state of this structure and the ground substance generally. This laboratory is now engaged in studies designed to elucidate some of the properties of this structure in the gastrointestinal tract.

The mechanism of the connective tissue changes described is not yet clear. Changes in basement membrane and ground substance of connective tissue generally are thought to be associated with the hypersensitive state. The fact that localized periarthritis (4) is frequently seen in ulcerative colitis is highly suggestive. Many of the so-called complications of ulcerative colitis—i.e., arthritis, erythema nodosum, and glomerulitis—are compatible with the concept of

ulcerative colitis falling into the collagen disease group, as is the response of the disease to ACTH (5, 6). Further studies in this direction are in progress.

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Manuscript received July 5, 1951.

Comments and Communications

Articulate Science

IN RECENT ISSUES of SCIENCE there has been considerable interest in a number of problem areas, overlapping specialized fields, which are of concern to all scientists. The areas include, among others, scientific publications, ethics, monetary compensation, cost of research, loyalty oaths, combating pseudo-science, communication of scientific method and ideals to the public, public relations, religious limitation on science teaching.

The integrating factor underlying these areas is that they deal with human relations among scientists and with the scientist's relation to the social environment he encounters in his daily work. As such the problems are part of the broader field of scientific communication, which deals with all the media employed to facilitate the transfer of ideas in scientific fields.

John Pfeiffer, in his letter "Illiteracy Triumphant," in the July 13 issue of SCIENCE, asks very pointedly why individual scientists or individual scientific societies do not combat pseudo-science, such as is represented by Velikovsky's *Worlds in Collision*. He also asks whether there is an organization that can represent American science in this and similar problems.

The questions he asks are important and demand answers. The individual scientist, fully occupied with immediate professional problems, cannot devote much time to these areas. Individual societies are in a similar position. There appears to be a need for a new organization that will be primarily concerned with problems of communication. How shall such an organization be conceived so that it will become an important factor in furthering the aims of science?

In a narrow segment of the communications field, literature chemists were placed on an equal level with other chemists when the Division of Chemical Literature of the American Chemical Society was established in 1949. However, the communications field today must be broadened to include media of communication other than verbal, such as graphic, photographic, three-dimensional, auditory, and tactile. Associated problems of financing, freedom of communication, and extension of the media of communication to the general public must be considered. Communication is thus becoming a highly specialized field in itself, requiring specialized personnel and techniques.

Is the communications problem to be solved by forming, *ad infinitum*, a series of organizations to cope with each individual problem as it arises? Or can we form, on a broader and more systematic basis, one organization that could represent American science in combating pseudo-science and also in considering the related problems of effective media and public relations necessary for such a task? Could such an organization deal with problems in publications, ethics, etc.? An attempt to develop such an approach

will be made at the AAAS meeting on December 30 at the symposium "Operation Knowledge." The author of this note will present a paper on "A Proposed Organization of Communications Scientists."

An effective organization of communications scientists might be in a position to analyze systematically the following suggested areas: Aims and objectives of scientific communication; evaluation and improvement of existing media; accessibility of the products; development of new media; reducing the communications time lag; manpower, personnel standards, and professional training; ethical standards; financing; the role of government and of industry in science communication; international aspects; language; translation needs; abstracting needs; communication's role in the diffusion of scientific knowledge to the public; communication and the unification of the sciences; educational aspects; freedom of communication; advertising in scientific fields; public relations for scientists; the trade magazine's role in science communication; the development of centralized scientific information services; propaganda and scientific communication; and communication needs of the armed forces.

Interested scientists are requested to submit their views on the proposed organization.

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Enzyme-Substrate Complexes

THE growing interest in the calculation of the dissociation constants for enzyme-substrate complexes makes it desirable to simplify the currently used methods. The original method introduced by Michaelis and Menton (1913) was greatly improved by Lineweaver and Burk (*J. Am. Chem. Soc.*, **56**, 658 [1934]). Veibel (*Enzymologia*, **3**, 147 [1937]) introduced an even simpler procedure, which seems to have been completely overlooked in current publications. The principal purpose of this communication is to point out that this improved method exists. Although Veibel apparently never published the derivations of the equations involved, an independent derivation has been published by the writer (W. Pigman and R. M. Goepff, Jr. *Chemistry of the Carbohydrates*. New York: Academic Press, 480 [1948]).

There is also considerable current interest in the nature of covalent, easily dissociable bonds, such as appear to be present in some types of protein-coenzyme and enzyme-substrate compounds. In this connection it may be noted that reactions between amino compounds and sugars provide at least an analogy. Glycosylamines are readily synthesized and dissociated under physiological conditions, and the position of the equilibrium is dependent on the nature

of the amine and on the pH (Pigman, Cleveland, Couch, and Cleveland. *J. Am. Chem. Soc.*, **73**, 1976 [1951]). Isomerization may result during the period of combination. Isbell and Frush (*Ibid.*, **72**, 1043 [1950]) showed that the curve for hydrolysis rate vs pH of one of these compounds is similar in shape to typical pH-activity curves for enzyme-catalyzed reactions. This analogy is interesting, even if not more significant.

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Photoinactivation of Indoleacetic Acid

IN A recent issue (*SCIENCE*, **113**, 300 [1951]), R. G. Ferri and R. Guidolin state that "... the photoinactivation of indoleacetic acid (phytohormone) by riboflavin discovered by Galston ... should be explained by a mechanism in which riboflavin did not act specifically, since the same inactivation could be brought about by many different substances. Although chemically unrelated, all these compounds had in common the property of fluorescence." This statement is based on an article by M. G. Ferri (*Arch. Biochem. Biophys.*, **31**, 127 [1951]), in which it is shown that many fluorescent substances can in fact sensitize the photoinactivation of indoleacetic acid.

These authors fail to consider two points: (a) The fact that riboflavin is not specific, for the reaction is well known, and is alluded to in my paper (*SCIENCE*, **111**, 619 [1950]): "... other fluorescent pigments, some of a non-biological nature, are also effective in such reactions. ..."

(b) The reason for considering riboflavin to be the effective pigment is that the action spectrum for the destruction of indoleacetic acid by a plant *brei* corresponds extremely well with the absorption spectrum of riboflavin (*Am. J. Botany*, **36**, 773 [1949]). Although this is not absolute proof that riboflavin participates in the reaction, it is certainly very strong evidence. In any event, it rules out the other fluorescent pigments discussed by the above authors, on the grounds that their absorption spectra do not fit the photoinactivation data.

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IT SEEMS TO US that Dr. Galston feels we did not fully recognize the great importance of his discovery. That is not so. As can be seen from the quotation Dr. Galston made from our paper, we have clearly given him full credit for the most important finding that riboflavin induces the photoinactivation of indoleacetic acid.

On the other hand, though it does not seem particularly important to us, we do not quite agree with his statement that "The fact that riboflavin is not specific for the reaction is well known and is alluded to in my paper" [his present letter].

It is true that such an allusion was made, but only in a very general way, when Dr. Galston states (*SCIENCE*, **111**, 619 [1950]): "Thus it is clear that riboflavin may cause the photochemical alteration of many different kinds of molecules, both large and small. It should also be pointed out that other fluorescent pigments, some of a non-biological nature, are also effective in such reactions."

In M. G. Ferri's paper, on the other hand, a very particular statement is made (*Arch. Biochem. Biophys.*, **31**, 127 [1951]): "These results indicate quite clearly that the induction of the photoinactivation of indoleacetic acid (IAA) is by no means a peculiarity of riboflavin but is a property common to many fluorescent substances."

Thus the situation, as we see it, is that, whereas Galston made a very general statement, M. G. Ferri made a specific one, based on many experimental data.

As for Galston's second comment, that only riboflavin can be concerned in the photoinactivation of indoleacetic acid by a plant *brei*, we do not wish to discuss it, since in our paper we were not concerned with this problem.

We agree with Dr. Galston that his is very good evidence that riboflavin participates in the reaction of the plant *brei* he studied—namely, the *brei* of etiolated pea epicotyls (*Am. J. Botany*, **36**, 773 [1949]). However, we feel that plant *breis* of various other species should be studied before the participation of other fluorescent substances can be definitely ruled out.

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Polymerization by Means of High-Energy Electrons

THE report of J. V. Schmitz and E. J. Lawton (*SCIENCE*, **113**, 718 [1951]) on initiation of vinyl polymerization by high-energy electron irradiation evoked long-submerged memories of this writer's and his associates' work of two decades ago. The work took its origin in 1931 from a discussion of the requirements of receptacle surface conditions for the delay in coagulation of blood extravasates, during which the young physicist associate of our Central Laboratory and Hormone Research Institute of the City of Mannheim recalled an earlier observation that vacuum-tube irradiation increases the water repellency of glass surfaces. Experiments in which glass slides were exposed in cathode-ray tubes confirmed the observation. Analysis of the experiments indicated that the stopcock grease evaporating from the connections of the tube to the evacuation pump was responsible for the phenomenon, and disclosed the repellency to be the property of a minute film formed on the exposed glass surfaces. The film was strongly adherent to the glass and highly resistant to various kinds of harsh chemical and mechanical treatment. Our observations held out not only the promise of a particularly costly method

of producing plastics, but also that of methods for imparting weather- and wither-fast surfaces to many sorts of indoor and outdoor objects and water-shedding surfaces to glass panes, of producing insulating coatings, of liquefying gases, etc., and of inducing types of chemical reactions not easy to activate by means of thermic or photo-energy, or pressure.

Because of these possibilities, the study was continued, first in the cathode tube, later with the electron beam from a "window tube," accelerated by a high-voltage field (500,000 v), part of the endeavors being directed to delineating the range of substances susceptible to this type of polymerization and part to defining the underlying chemical mechanism. It turned out that all organic substances studied were polymerizable. Chemicals as diverse as fatty oils, retene, glucose, and paraffin were all converted into films with the above characteristics, when exposed in a thin layer on a glass slide. The diversity of susceptible substances and the decrease in oxygen content of glucose after its conversion to the polymer suggested that the electron impact is capable of ejecting both hydrogen and various substituents from their bonds with C, in preference to the breaking of C—C bonds, and of activating the freed valences for intermolecular bondings.

Just as these investigations were reaching the stage of making quantitative comparisons of the susceptibilities of the various substances with improved equipment, the Herostratic firebrands of 1933 halted them, dispersed the members of the team and its records, and even smothered contact, continuation, and recollection by the blanket of an intimidation- and terror-borne amnesia. This background of frustration, together with the writer's frankly confessed innocence in all matters pertaining to electrophysics, should suffice to make it clear that these historical reminiscences are not intended to raise any claim of that *vanitas vanitatum*, priority. They are, however, believed to deserve brief mention because, despite their fragmentariness and lack of detail, they may contribute some qualitative information to the results of the admirably careful and expert quantitative investigation of the G-E investigators. Their work could indicate that the presence of double bonds is a prerequisite of successful attack of the high-energy electrons. Our observations show that saturated compounds also are readily polymerized; they do not preclude the possibility that the tension prevailing at sites of unsaturation favors activation, which may find expression in quantitative differences.

The effect upon the glass surface was first reported in a subordinate sentence in a publication of the 1880s; its author, who thus deserves the laurel of priority—although he may have been unaware of the mechanism—is Heinrich R. Hertz; but, unfortunately, this writer is unable to recollect the literature in which the quotation appears, or the source of the electron beam employed in those early experiments. Even the fragmentary information reported here would not have been obtained if the writer's laboratory had not been distinguished by such members as the keen

physicist whose name is buried in the aforementioned nazigenic gap of memory, and the biochemist Erich Adler, of Stockholm.

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Food Reactions of Amoebas and the Manipulation of Nematocysts of *Hydra* by *Microstomum*

IN 1910 Rhumbler (1) described two significant types of food reactions of an amoeba, naming them *circumfluence* and *circumvallation*. In *circumfluence*, food is engulfed by the amoeba's body flowing intimately about it, as a drop of oil flows about a bit of sand. In *circumvallation*, the amoeba surrounds a motile object of food in a wide embrace, but at no place in contact with the food.

Two of us (2) showed how variable were the details of *circumvallation*.¹ Goldstein (3) recorded that a given amoeba could use either *circumfluence* or *circumvallation* in a sustained food reaction to a given object of prey, as the situation demanded.

My students and I had overlooked Rhumbler's paper, so we unwittingly corroborated his observation. Looper (4) observed that a filopod also captured food by these two methods. We observed these reactions on the part of two amoebas, in addition to Rhumbler's one, and upon a filopod (to Rhumbler's none). Hyman (5) later included both lobopods and filopods, thus corroborating both our work and Rhumbler's.

Rhumbler did not note the highly significant fact that *circumfluence* is correlated with the ingestion of nonmotile food, whereas *circumvallation* is correlated with the capture of motile prey that presented the contingency of escape (6, 7). He sought to reduce these reactions to terms of the past and present, and attempted to establish an analogy between melting paraffin flowing about a heated glass bead and *circumvallation*. We indicated that the future, as well as the past and present, was a factor in amoebas' reactions to food. Hyman (5, p. 122) corroborated this feature of our work when she wrote: "Lobopods and filopods employ *circumfluence* (Fig. 37 D) in ingestion of immobile prey but capture active prey by *circumvallation*."

In my recent studies, I have observed that some motile objects of food present a peculiar feature. These move at a uniform rate, like a marble down a slight incline. Their projected paths are predictable. Amoebas ingest such food objects (diatoms and fission algae) by *circumfluence*, just as a man lays hold of a rolling marble directly without being concerned about probable lines of escape.

So it happens that an amoeba's conduct is much more complex than Loeb (8, p. 321) had in mind when he wrote that amoeba's movement "differed little

¹ Frank R. Lillie wrote that he was pleased to publish this paper in the *Biological Bulletin*, since it indicated how highly educated were Virginia amoebas.

from spreading." Amoebas circumvent contingencies as they are presented, and the future constitutes a factor in their conduct as it does in that of men.

The following statement by Hyman (9, p. 72) calls for comment: "Kepner and his students conclude that *Microstomum* seeks hydras 'for the purpose' of obtaining their nematocysts 'in order' to use these nematocysts against prey. The question whether *Microstomum* is able to capture prey without the use of nematocysts is not considered by these authors; the lack of this control weakens the whole argument."

Had she read all our papers upon *microstomum's* nematocysts more carefully, she would have discovered that we had not used the word "prey" at any place, though we had quoted Martin (10) as having used it. It was not our "argument" that these flatworms need nematocysts to "capture prey." They obviously do not need these "guns" ordinarily to obtain food any more than a soldier ordinarily needs his gun to capture food.

In reading our papers recently I was surprised to find that they actually contain some evidence that *microstomum* may use its nematocysts "in order to capture prey." For example, Martin (10, p. 268) found "one of the commonest enemies of *Microstomum* appears to be *Chaetogaster*, which devours it greedily." It is my inference that Martin's *microstoma* must have lacked nematocysts, for several years later we found loaded *microstoma*, living in an adjacent pond, feeding freely upon chaetogasters. This suggests that our loaded *microstoma* were using their alien nematocysts in order to capture "one of their commonest enemies" for food.

Finally, we find that we actually recorded two examples in which a *microstomum* had immobilized a

stenostomum by means of nematocyst-wounds and then ingested the wounded prey.

In the face of this evidence, the burden of proof seems to lie upon the shoulders of those who deny that *microstomum* sometimes uses its alien "guns" to capture food, just as a soldier may sometimes use a captured enemy gun to capture the enemy's calf.

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Erratum

It has been called to our attention that in the Nov. 9 issue of *SCIENCE* (114, 516 [1951]), the death of Professor H. Galliard, of the Faculté de Médecine de Paris, Institut de Parasitologie, was erroneously reported.—Editors.

Book Reviews

Oeuvres Complètes de Christiaan Huygens: Supplément, à la Correspondance, Varia, Biographie de Chr. Huygens, Tome XXII. The Hague: Martinus Nijhoff, 1950. Published for the Société Hollandaise des Sciences, 921 pp.

This volume completes the collected works of Christiaan Huygens (1629-95), one of the great men of science in the seventeenth century, whose many contributions to science include the optical principle that bears his name, the modern pendulum clock escapement, improvement of the telescope and consequent resolution of Saturn's ring, and the analysis of forces in uniform circular motion. This edition was initiated by the Dutch Academy of Sciences in 1885, and the first volume appeared in 1888; Volumes 16-22 have been edited by J. A. Vollgraff, and the preceding ones by D. Bierens de Hahn, J. Boscha, and D. J. Korteweg, respectively. The first ten volumes contain correspondence (both letters by Huygens and those written

to him), the remaining volumes being devoted to special scientific topics—mathematics, probability, dioptries, physical optics, astronomy, horology, cosmology, dynamics—including annotated editions of his printed works as well as shorter pieces and manuscript notes.

This last volume contains a supplement to the published correspondence, various small items omitted from previous volumes, a bibliography of the material published by Huygens in his lifetime; marginal notes made by him in reading the *Acta Eruditorum*, a facsimile of the bookseller's catalogue of Huygens' library, and a 400-page biography of Huygens by Vollgraff. The latter is a mine of information concerning every aspect of Huygens' life and the development of his thought. Since Huygens traveled widely, was well acquainted with the leading scientists of his day, as well as being keenly interested in scientific questions of every sort, this biography contains an abundance of material for anyone interested

ADW
See if you can
get me this
one.

in any aspect of scientific thought in the seventeenth century. Incorporated in the biography are many autobiographical documents not hitherto printed, such as journals kept during travels and itineraries.

Particularly valuable for our understanding of the development of Huygens' thought is the account given of books he purchased or read and his comments concerning them. Discussions of leading issues of the day, such as Newton's theory of gravitation, illuminate the state of scientific knowledge and its dissemination. While much of the information will not interest most scientists (who will not care, for example, whether Huygens hired two valets or one, and so on) the biography nevertheless is a source of primary value to all who care to look back at the founding period of modern science.

Like the other volumes, this one is handsomely printed on handmade paper, each sheet being watermarked "Christiaan Huygens." It contains an index and a detailed table of contents, and the many notes enable readers of the biography to find further information in previous volumes concerning any topic they encounter. The completion of this splendid project makes us wish that similar editions existed for other great men of science, such as Newton and Lavoisier.

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Alkali Soils: Their Formation, Properties and Reclamation. W. P. Kelley. New York: Reinhold, 1951. 176 pp. \$5.00.

The author has integrated an extensive background in research and practical experience, with historical and modern findings on alkali soils, in this significant treatise of value to students of arid agricultural regions. The book gives an extensive review of the principal findings in the chemistry of these soils. The viewpoint is that of workers at the University of California, but few of the conclusions reached will be questioned by other specialists.

The general term "alkali soils," given by Hilgard as a generic name for all soils affected with salt, is employed. But the author has not gone further and selected terminology for subclasses of these soils. In effect, the adoption of the older term for salt-affected soils renounces the terminology proposed by de Sigmond and adopted with modification by the U. S. Salinity Laboratory, the Soil Science Society of America, and most soil scientists of the western United States.

Treatment of the origin of salts, their effects on soils, cation exchange processes, irrigation in relation to alkali, and the reclamation of alkali soils is particularly valuable. The physical problems of alkali soils are considered only briefly. Plant relations to salt and alkali soil conditions have been more adequately covered in recent publications by Wadleigh and others.

There are hundreds of thousands of acres of alkali

soils in the Western states that cannot be economically reclaimed in the foreseeable future. A section on the problems involved in increasing crop production on these nonreclaimable soils would have been a welcome addition to the book.

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The Kidney: Structure and Function in Health and Disease. Homer W. Smith. New York: Oxford Univ. Press, 1951. 1,049 pp. \$12.00.

This eagerly awaited book is as unique, valuable and as much a landmark as Cushny's *The Secretion of the Urine*. Its skillful dialectic critically integrates some 2,300 references from a field whose recent rapid growth derives in large part from the author's basic concepts and techniques. Some of the observations cited were unpublished elsewhere at press time, and the text throughout is presciently up to date.

Part I touches briefly on anatomy and deals at length with excretory physiology in terms of clearance. Part II reviews mechanisms of renal maintenance of body fluid and extra-renal controls of these equilibria. Part III surveys renal circulation and hemodynamics, renotropic factors, age-conditioned changes in function and comparative physiology. Part IV is a review of renal function in disease.

This array of subject matter is presented under 27 chapter headings in a proportioned, objective, and, within limitations of present-day knowledge, satisfying manner. Coverage of adrenal function is not up to the decisive level of the text as a whole, probably from the nature of the topic. Chapters on electrolytes and acid-base equilibria must have been hard to write, for they are not easy to read. Errata which will only occasionally puzzle the reader are just numerous enough to permit the quotation from Horace that "Even the worthy Homer sometimes nods." Inclusion of heparin under "other proteins" and characterization of hemoglobinurias as hematurias are probably unjustified. The chapter on diuretics gives the impression of having been tacked on.

Many of the topics are controversial. Those familiar with specific aspects may not agree with some of the summaries proposed. But they too will be glad to have the book and to recommend it.

The book is too large for cursory reading. It will be most used for reference. It should be available to all engaged in physiology, pharmacology, or clinical science. Physicians will find Parts I through III often too detailed to hold their interest and in Part IV much fact but no prescriptions. The illustrations are mostly charts and will discourage those who want science in tabloid form. But these charts refresh and illumine the record. Dr. Smith deserves every congratulation for this remarkable contribution to physiological literature.

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Native Orchids of North America. Donovan Stewart Correll. Waltham, Mass.: Chronica Botanica; New York: Stechert-Hafner, 1950. 399 pp. \$7.50.

This is a superbly illustrated manual of all orchid species of North America, north of Mexico. Based largely on the Orchid Herbarium of the Botanical Museum of Harvard and on the extensive field work of the author, the treatment of some 150 species of orchids in 46 genera is complete and satisfying. The 146 well-reproduced plates illustrating the book are mostly the work of Blanche Ames and Gordon W. Dillon, two of the outstanding botanical artists of our times. The account of each species includes a brief synonymy, a complete botanical description, a summary of geographical distribution, often a statement of habitat preferences, and a paragraph or two of cultural notes. The latter were contributed by Edgar T. Wherry, of the University of Pennsylvania, and John V. Watkins, of the University of Florida.

The taxonomic treatment on the whole is conservative, although there are a few surprising omissions. Thus *Spiranthes cernua* var. *ochroleuca* (Rydb.) Ames is dismissed on the grounds that a compound microscope is needed to determine the diagnostic character! *Habenaria media* (Rydb.) Niles is missing altogether, although this may be an unintentional oversight. Perhaps the most questionable treatment is the combination of *Cypripedium pubescens* Willd. and *C. parviflorum* Salisb. into a single variety of the Eurasian *C. calceolus* L., from which they are said to differ by a polymorphic tendency.

Despite these few shortcomings, the book will no doubt stand for years as the authoritative reference work on our native species of this interesting family.

JOHN T. CURTIS

Department of Botany
University of Wisconsin

Medicinal Chemistry, Vol. I. C. M. Suter, Ed. New York: Wiley; London: Chapman & Hall, 1951. 473 pp. \$12.00.

Medicinal Chemistry, Vol. I. Alfred Burger. New York-London: Interscience, 1951. 577 pp. \$10.00.

Both these books are recommended to the chemist and pharmacologist concerned with the synthesis and evaluation of new compounds. The volume edited by Suter is the first of a series prepared under the auspices of the Division of Medicinal Chemistry of the American Chemical Society. This consists of 6 separate reviews written by 7 investigators of reputation: G. W. Anderson, "Antithyroid Compounds;" Robert R. Burtner, "Antispasmodics, Derivatives of Carboxylic Acids;" C. J. Cavallito, "Antibiotics from Plants;" Thomas P. Carney, "Benzoates and Substituted Benzoates as Local Anesthetics;" and finally, Edwin J. Fellows and Glenn E. Ulyot contributed the discussion of "Aralkylamines" under "Analgesics;" John Lee prepared the accompanying material on "Partial Structures, Related."

Each of these reviews is actually a complete mono-

graph in itself. References are made to all compounds that have been investigated for a particular type of pharmacological activity. For the most part, data on the compounds are presented in tabular form and according to chemical groups. The methods of synthesis and testing are adequately presented for a volume of this sort. Each reviewer also includes a discussion of the relationship between chemical structure and pharmacological activity. This volume should be an excellent source book for those interested in these specific fields—particularly since numerous references are included to groups of compounds in the patent literature alleged to have specific pharmacological activity for which there are no published supporting data.

Although the various sections in the volume by Burger bear classical textbook headings, the work is designed primarily for the more advanced student and is highly recommended as a work that will familiarize him with current trends and thoughts in pharmacological research. Unfortunately, at the time of this writing, Volume II of this work was not available. However, on the basis of the style of writing and organization of the material in Volume I, the complete set promises to be a valuable addition to the personal library of biochemists and pharmacologists. The chapters on the chemical and physical properties in relation to biological activity are especially worthy of mention. Those on the adrenergic drugs, blocking agents, and parasympathetic stimulants cover the most recent developments in fields now in an unusual state of flux.

DAVID B. TYLER

School of Medicine
University of Puerto Rico

The Neuroses: Diagnosis and Management of Functional Disorders and Minor Psychoses. Walter C. Alvarez. Philadelphia-London: Saunders, 1951. 667 pp. \$10.00.

Dr. Alvarez writes in his usual intriguing, easy-to-read style, enlivened with case material garnered from 45 years of practice. His purpose is commendable—to arouse the interest of physicians in recognizing and properly treating the enormous number of patients who seek help for "functional" illness. Twenty-nine chapters cover a general orientation to the problem of neurosis, diagnosis, causes of neuroses and psychoses, types of personality and several syndromes, the psychosomatic features of the several specialties, and treatment. The content of these chapters is of variable merit. The exhortation to listen sympathetically to the life problems as well as physical symptoms of the neurotic patient is wisely repeated in many ways. The need for careful study of both somatic and psychic factors is justly stressed. Diagnosis, however, is made predominantly by superficial observation, unrelated to principles of modern dynamic psychiatry.

In discussing causes of neurosis, greatest emphasis seems to be placed on "poor nervous inheritance," an

idea which many psychiatrists do not share. This 'poor heredity' is often used by Alvarez to account for a poor prognosis. But clinical experience shows that such pessimism is unwarranted; many patients get well despite a highly neurotic background. The descriptions of neuroses and neurotic syndromes range from fairly accurate generalities to grossly inaccurate specific statements. A reader of even moderate psychiatric sophistication might well be shocked by such a blatant error as "women are perhaps ten times as subject to neuroses as men are."

The five chapters on treatment are largely various admonitions to be a kindly, understanding physician, able to give sound advice and not scold patients. To the reviewer this attitude is one which a good doctor has with all patients, and is merely the first step toward treating a neurotic. The discussion of psycho-

therapy is limited, superficial, and inadequate, and the author seems biased in his derogation of psychoanalysis.

In his preface Alvarez says the book is written by a nonpsychiatrist for nonpsychiatrists. The result is what one would expect—a nonpsychiatric book. Although it beautifully describes how to be a good doctor, the volume adds little to the sound diagnosis and management of neuroses, and, in a rather cavalier manner, ignores most of the recent excellent work of many investigators in the field of psychosomatic medicine and neurotic disorders. It is regrettable that a book with such worth-while aims, by such an able author, cannot be given greater praise.

BRANDT F. STEELE

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University of Pennsylvania Medical School

Scientific Book Register

Principles of Weed Control. Gilbert H. Ahlgren, Glenn C. Klingman, and Dale E. Wolf. New York: Wiley; London: Chapman & Hall, 1951. 368 pp. \$5.50.

Introduction to Number Theory. Trygve Nagell. New York: Wiley; Stockholm: Almqvist & Wiksell, 1951. 309 pp. \$5.00.

Insects as Human Food: A Chapter of the Ecology of Man. F. S. Bodenheimer. The Hague, Netherlands: Dr. W. Junk, 1951. 352 pp. 10 guilders.

Synthetic Methods of Organic Chemistry, Vol. 5. With cumulative index of Vols. 1-5. W. Theilheimer. Basel: S. Karger; New York: Interscience, 1951. 612 pp. \$14.00.

Lumineszenz: Ergebnisse und Anwendungen in Physik, Chemie und Biologie. Fritz Bandow. Stuttgart: Wissenschaftliche Verlag, 1950. 255 pp.

Preparation, Properties, and Technology of Fluorine and Organic Fluoro Compounds. National Nuclear Energy Series VII-1. Charles Slessor and Stuart R. Schram, Eds. New York-London: McGraw-Hill, 1951. 868 pp. \$10.50.

Decompression Sickness: Caisson Sickness, Diver's and Flier's Bends and Related Syndromes. Compiled under the auspices of the Subcommittee on Decompression Sickness, Committee on Aviation Medicine, Division of Medical Sciences, National Research Council. John F. Fulton, Ed. Philadelphia-London: Saunders, 1951. 437 pp. \$8.50.

Algae of the Western Great Lakes Area—Exclusive of Desmids and Diatoms. G. W. Prescott, Bloomfield Hills, Mich.: Cranbrook Inst. of Science, 1951. 946 pp. \$10.50.

Organic Syntheses, Vol. 31. R. S. Schreiber, Ed. New York: Wiley; London: Chapman & Hall, 1951. 122 pp. \$2.75.

X-Ray Analysis of Crystals. Eng. ed. of *Röntgenanalyse von Kristallen*. J. M. Bijvoet, N. H. Kolkmeier, and Caroline H. MacGillivray; trans. by H. Littman Furth. New York: Interscience; London: Butterworths, 1951. 304 pp. \$6.50.

Physical Chemistry of Lubricating Oils. A. Bondi. New York: Reinhold, 1951. 380 pp. \$10.00.

Psychoanalysis, Man, and Society. Paul Schilder. New York: Norton, 1951. 382 pp. \$4.00.

New and Nonofficial Remedies. Issued under the direction of the Council on Pharmacy and Chemistry, American Medical Association. Philadelphia-London: Lippincott, 1951. 782 pp.

College Algebra. 2nd ed. Raymond W. Brink. New York: Appleton-Century-Crofts, 1951. 495 pp. \$3.75.

Introduction to Modern Chemistry. F. C. Gaines, Laurence O. Binder, Jr., and Ray Woodruff. St. Louis: Mosby, 1951. 576 pp. \$4.75.

Fundamentals of Soil Science. 2nd ed. C. E. Millar and L. M. Turk. New York: Wiley; London: Chapman & Hall, 1951. 510 pp. \$5.50.

Advances in Food Research, Vol. III. E. M. Mrak and George F. Stewart. New York: Academic Press, 1951. 518 pp. \$9.50.

Fundamental Principles of Physical Chemistry. 2nd ed. Carl F. Prutton and Samuel H. Maron. New York: Macmillan, 1951. 803 pp. \$5.75.

The Surface Chemistry of Solids. S. J. Gregg. New York: Reinhold; London: Chapman & Hall, 1951. 297 pp. \$8.50.

The Dusky-footed Wood Rat. A record of observations made on the Hastings Natural History Reservation. Jean M. Linsdale and Lloyd P. Tevis, Jr. Berkeley: Univ. California Press, 1951. 664 pp. \$7.50.

Corrosion Guide. Erich Rabald. Houston-Amsterdam: Elsevier Press, 1951. 629 pp. \$12.50.

Psychosomatic Gynecology: Including Problems of Obstetrical Care. William S. Kroger and S. Charles Freed. Philadelphia-London: Saunders, 1951. 503 pp. \$8.00.

Statistical Methods for Chemists. W. J. Youden. New York: Wiley; London: Chapman & Hall, 1951. 126 pp. \$3.00.

Radiologic Physics. Revised 2nd ed. Charles Weyl and S. Reid Warren, Jr. Springfield, Ill.: Thomas, 1951. 491 pp. \$10.50.

News and Notes

Italian Congress on Aerosol Therapy

A TWO-DAY meeting of the Italian Congress on Aerosol Therapy was held in Turin (July 1-2) as a part of an elaborate series of medical meetings and exhibitions sponsored by the Italian Medical Association and the Minerva Medical Society (an association of medical authors). There were more than 60 specialized professional group meetings with 1,383 participants, who read 1,612 papers. About 4,000 attended, representing 30 countries. Over 100 were registered for the meetings on aerosol therapy. These meetings were dedicated to Luigi Rolando (1773-1831), former son of Turin and for many years professor of anatomy at the university there. Special honors were given to Blalock (USA), Zonde (Israel), and Leriche (France).

The Congress on Aerosol Therapy had a varied program. L. Dautrebande (Belgium) discussed the agglutination of solid aerosols (dusts) of siliceous material by exposure to another aerosol of sodium chloride, which caused agglutination. This has practical application in the mining industry, where it can be employed to prevent silicosis. R. Tiffeneau (France) gave an illustrated talk on the action of eupnoeic aerosols on the bronchi and alveoli, as determined by spirometric studies. Two factors are involved in the improvement of pulmonary ventilation by the use of eupnoeic agents (such as adrenaline, theophylline, etc.)—namely, broncho-dilating action and alveolar moving power, and not by the former alone, as is frequently taught. S. J. Prigal gave a historical review of the development of aerosol therapy in the U. S., as well as a résumé of his studies with steam-generated aerosols, particularly with reference to the use of specific antibiotics for the treatment of sino-respiratory infections.

G. Dellepiane (Italy) described a novel application of aerosols in the field of obstetrics and gynecology, in which antibiotics (penicillin, chloromycetin) and hormones (estrogens, gonadotropins, and progesterone) were employed, either by inhalation and absorption through the pulmonary field or applied through the genital route as an aerosol. Evidence of absorption in animals and humans was presented for both the antibiotics and the hormones, and the conclusion was reached that these aerosols may find an adjunct position to those modalities already employed in this field. Micheli (Italy) discussed problems in need of further investigation, such as surface tension and viscosity in the formation of aerosols, electrical charges of the dispersed particles, and absorption and distribution of aerosolized substances. Aerosol therapy in the practice of otolaryngology was discussed by P. L. Remaggi (Italy) and in the practice of pediatrics by C. Torricelli (Italy). The latter emphasized the usefulness of administering therapeutic agents for systemic action in the form of aerosols via the pulmonary route (dia-

pulmonary therapy). This method of treatment has been advocated by G. Guassardo and his associates at the University of Turin. In the pediatric service headed by Professor Guassardo there is an installation of aerosol chambers in which several children are simultaneously treated by a constant aerosol automatically controlled by an electronic device. In this fashion meningitis is treated with specific antibiotics without resorting to injections. The chambers and mechanisms controlling the concentration of the aerosols were exhibited and were one of the highlights of the convention. How feasible in practice this method of therapy will be remains to be seen.

Another novel application was described by P. Sangiorgi (Italy), who uses aerosols of antigens in allergic patients for specific desensitization. He has also found aerosols of mineral waters useful in the treatment of chronic bronchitis and bronchiectasis.

L. Bonelli (Italy) presented fundamental studies on the physical-chemical-electrical aspects of aerosols, methods of production, determination of size, and evaluation of dosage. For the last of these studies he has modified a spirometer so that the effect of aerosols of various types may be recorded as they modify pulmonary functions.

At the end of the convention, Professor Dautrebande proposed the establishment of an International Society of Aerosology with headquarters in Turin. Drs. Bohn (Germany), Dautrebande, Prigal, Tiffeneau, and Wolfer-Bianchi (Italy) were nominated as representatives of this proposed society in their countries.

The meetings, on the whole, reflected a great deal of enthusiasm for aerosol therapy in Europe and ingenuity in its application. Considering the progress and extent of application of this form of therapy in Italy and France, as observed by the author, there is much to be done in this country.

SAMUEL J. PRIGAL

55 Park Ave., New York

Scientists in the News

Edwin B. Astwood, of Tufts College Medical School, has received the 1951 Borden Award for his research on the production of ACTH. The award of \$1,000 cash and a gold medal, established by the Borden Foundation, was given at the annual dinner of the Association of American Medical Colleges.

The Standard Oil Company (New Jersey) has announced reorganization of six affiliates operating in the Caribbean area into Esso Standard Oil, S. A., and the appointment of Fred H. Billups as president of the new company. Henry H. Blackeby, assistant controller of Standard of New Jersey, was named chairman. Headquarters of the new company will be in Havana, Cuba.

John E. Boysen, USAF (MC), has been elected to fellowship in the American Academy of Occupational Medicine. Colonel Boysen is deputy air surgeon for the Air Materiel Command located at Wright-Patterson Air Force Base, Dayton.

Philip H. Coombs has been named director of research of the Fund for the Advancement of Education and will join the organization next March after he has completed his duties as executive director of the President's Materials Policy Commission.

Martin Gusinde has been appointed research professor of anthropology at Catholic University. Dr. Gusinde has recently returned from South Africa, where he investigated the Bushmen-Hottentot.

George M. Hocking, who resigned his position at the University of New Mexico College of Pharmacy (Albuquerque) in March to accept a temporary assignment as Technical Expert on Medicinal Plants, FAO, after three months of travel in West Pakistan and three of study in various institutions in England, France, Switzerland, and Italy, is now serving as professor of pharmacognosy at the School of Pharmacy of the Alabama Polytechnic Institute. He was recently appointed a member of the Comissão de Estudos de Plantas Brasileiras, Mediciniais e Tóxicas, Universidade de São Paulo.

Charles D. Hurd has been appointed to the first Clare Hamilton Hall research professorship in organic chemistry, established this fall at Northwestern University by the Pittsburgh Plate Glass Company. This professorship will be supported by a yearly grant from the company and is named in memory of the director of the company's Milwaukee paint division from 1921 until his death in 1930. Previous to this appointment, Dr. Hurd held the chair of Morrison professor of chemistry at Northwestern.

Charles P. Hutter, formerly research associate, Chemical-Biological Coordination Center, National Research Council, has been appointed executive secretary, Division of Research Grants, National Institutes of Health, Bethesda, Md.

Raymond W. Jacoby of the Ciba Company, Inc., has been awarded the Olney Medal for outstanding achievement in textile chemistry. The medal, given annually by the American Association of Textile Chemists and Colorists was established by the Howes Publishing Company in honor of the late Louis A. Olney, of Lowell Textile Institute.

Thomas H. Johnson, chairman of the Physics Department of Brookhaven National Laboratory, has been appointed director of the Research Division of the U. S. Atomic Energy Commission. The position has been vacant since June 15, when **Kenneth S. Pitzer** resigned to become dean of the College of Chemistry, University of California (SCIENCE, 113, 734 [1951]). Dr. Johnson served as chief physicist at the Aberdeen Proving Ground during World War II and in 1946

and 1947 was associate director at Aberdeen until joining the Brookhaven staff.

F. E. Kelsey has been appointed as director of radiochemistry at Nuclear Instrument & Chemical Corp., Chicago. Dr. Kelsey joined the firm after 11 years at the University of Chicago, where he was associate professor of pharmacology.

James H. Pannell, formerly chief of the physics section at the MIT Mineral Engineering Laboratories, is now with the American Cyanamid Company at Idaho Falls, Idaho.

A fellowship in the Photographic Society of America has been awarded to **Konstantin Pestrecov**, head of the Photographic Department of Bausch & Lomb Optical Company's Scientific Bureau, in recognition of his "numerous contributions to the advancement of photography in the scientific, technical, and educational fields." A member of Bausch & Lomb's Scientific Bureau since 1940, Dr. Pestrecov is a designer of aerial camera and motion-picture lenses.

Columbia University has appointed **Robert R. Serber**, theoretical physicist, as a professor of physics. A founder of the Los Alamos experimental laboratory and a consultant to the Brookhaven National Laboratory, Dr. Serber formerly was on the faculty of the University of California.

Alex J. Steigman, professor of child health at the University of Louisville School of Medicine, is the recipient of a grant-in-aid from the National Foundation for Infantile Paralysis, Inc., for studies on experimental poliomyelitis.

Directors of the J. T. Baker Chemical Company, Phillipsburg, N. J., have elected **Joseph R. Stevens** vice president. Dr. Stevens joined the company in 1944 as director of organic research.

Herluf H. Strandkov, Department of Zoology, University of Chicago, has been elected editor of *The American Journal of Human Genetics*, starting Jan. 1, 1952.

Chester M. Suter, divisional vice president of the Sterling-Winthrop Research Institute, has been elected chairman of the American Chemical Society's Division of Medicinal Chemistry, succeeding **Richard O. Roblin, Jr.**, of the American Cyanamid Company. **J. M. Sprague**, of Sharpe & Dohme, Inc., was chosen chairman-elect, and **M. G. Van Campen**, of the Wm. S. Merrell Co., was named secretary-treasurer.

The American Society of Heating and Ventilating Engineers has announced that **Ernest Szekely**, president of the Bayley Blower Company, has been nominated for president of the society in 1952. Nominees for other offices are **R. F. Taylor**, consulting engineer, Houston, and **L. N. Hunter**, National Radiator Company, Johnstown, Pa., vice presidents; and **J. Donald Kroecker**, consulting engineer, Portland, Ore., treasurer. Mr. Szekely is first vice president of the society.

Orders transferring **John M. Talbot**, who served as medical officer to Operation Crossroads, to the Air Research and Development Command in Baltimore have been issued at the Air Force School of Aviation Medicine. Colonel Talbot has been stationed at the aeromedical school since October 1946, where his last assignment was as head of the Department of Radiobiology. At Air Research and Development Command headquarters he will serve in the Aviation Medicine Division.

Osgood V. Tracy has been appointed deputy director of the chemical division of the National Production Authority. Mr. Tracy is on leave as general manager of the chemical products department of Esso Standard Oil Company.

Orville Frank Tuttle, Geophysical Laboratory, Carnegie Institution of Washington, is the first recipient of the Mineralogical Society Award. The Mineralogical Society Award will be given annually to a man under thirty-five years of age for "outstanding contributions to the mineralogical sciences."

Members of the International Council of Scientific Unions recently visited the National Bureau of Standards and were conducted on a tour of the laboratories. The attending members were: **A. von Muralt**, University of Bern, president of the council; **H. Solberg**, Oslo University, vice president of the council; **P. Fleury**, director, Institut d'Optique, Paris, representing the International Union of Pure and Applied Physics; **H. A. Kramers**, University of Leiden; **G. Laclavère**, National Geographic Institute of France, Paris; **J. N. Mukherjee**, Central Building Research Institute, Roorkee, India; **G. Sarton**, president of the International Union on History of Science, Harvard.

Martin G. Vorhaus has been appointed general medical director of the Doehler-Jarvis Corporation. Dr. Vorhaus has been practicing in New York since 1922 and holds the post of attending physician of the medical service at the Hospital for Joint Diseases in that city.

Paul Weiss, of the University of Chicago, has been elected a foreign member of the Swedish Royal Academy of Science in Group 7 (zoology). He was chosen for his outstanding work in the field of experimental embryology.

The National Bureau of Standards has appointed **David White**, acting assistant director of the Cryogenics Laboratory at Ohio State University, to its staff of consultants. He will serve as a part-time consultant in the thermodynamics section of the bureau's division of heat and power.

Two additions have been made to the Microbiology Department staff of the Baylor College of Medicine in Houston—**Robert P. Williams** and **Willson J. Fahlberg**. Dr. Williams has been named assistant professor of microbiology and Dr. Fahlberg instructor of microbiology. Dr. Fahlberg worked for more than six

years as an analytical chemist in petroleum research.

The Zoology Department of the U. S. National Museum was host to **James Zetek**, entomologist in charge of the Canal Zone Laboratory at Balboa for the Bureau of Entomology and Plant Quarantine and resident manager for the Smithsonian Institution of the Barro Colorado Island Biological Area, at a meeting attended by 45 zoologists working at or visiting the museum.

Education

Bard College has received as a gift the 825-acre Hudson River Estate of **Christian A. Zabriskie**. The estate, which adjoins the college property, increases the Bard campus area nearly twentyfold.

California Institute of Technology has purchased the personal library of the late **Chester Stock**, geologist, and has acquired by gift the mineral collection of **William C. Oke**, twice president of the Mineralogical Society of Southern California. Mr. Oke expects to continue to add species and varieties to his collection.

Duke University Medical School has begun a diagnostic and treatment center for speech and hearing problems in North Carolina. **Leslie B. Hohman**, professor of neuropsychiatry, **Murray Halfond**, former speech pathology clinician at Northwestern University, and **Kenneth L. Pickrell**, professor of plastic surgery, are cooperating in the program.

Hahnemann Medical College has received a gift of \$18,000 from the National Council of British Sholem Women for the establishment of a clinical laboratory for cardiovascular and pulmonary research; \$25,000 from the U. S. Public Health Service for the development of a heart-lung apparatus; and \$10,000 from an anonymous donor for the clinical study of bone metabolism in health and disease.

The University of Maryland has received the following grants for work in the Department of Pharmacology: from the National Institutes of Health, \$6,000 for investigation of cardiovascular disease; from **Eli Lilly & Company**, \$4,500 for the study of vasodilating drugs; from **Ohio Chemical & Surgical Equipment Company**, \$3,500 for studies in anesthesia; and \$2,500 from **Emerson Drug Company** for investigation of the mechanism of analgesia.

New York University's Advanced Technology Center at University Heights will be completed by a new Applied Science Building at an estimated cost of 3 to 4 million dollars. The new building will house research projects in all fields of engineering and also provide quarters for the Physics Department. The university's Engineering Research Division has announced new research contracts in electronics, rocket fuels, nuclear energy, metallurgy, biomechanics, and air and water pollution problems that bring the annual research expenditures to \$1,040,000, 17 per cent more than last

year. Harold K. Work is director of the Research Division.

Three faculty members in the North Carolina State's School of Agriculture have been named William Neal Reynolds distinguished professors of agriculture. The men honored were George H. Wise, head of the animal nutrition section in the Department of Animal Industry; James H. Jensen, plant pathologist in the Division of Biological Sciences; and Stanley G. Stephens, head of basic genetics in the same division. The endowment, established by the late William Neal Reynolds in 1950, is expected to improve rural living standards in North Carolina and support training and research in the various agricultural fields.

Grants and Fellowships

The East European Fund, Inc., of the Ford Foundation, formerly the Free Russia Fund, has recently made approximately \$200,000 available to independent organizations, principally those working in the field of initial reception and placement of arriving displaced persons. Most of the remaining funds were granted for the continuation of work begun last spring.

Through a grant from the Lalor Foundation, the Marine Biological Laboratory, Woods Hole, Mass., is offering a limited number of postdoctoral fellowships in the fields of biochemistry, biophysics, and physiological chemistry, designed primarily for young scientists desiring to work the entire summer on investigations for which the opportunities provided by the laboratory are particularly appropriate. The stipend is intended to cover laboratory fees, travel, and living expenses at Woods Hole. Applications should be received by Dec. 31. Blanks and further information may be secured from the Director of the Biological Laboratory.

Lincoln Arc Welding Foundation has given honors and cash awards to 63 undergraduate engineers representing 34 different engineering schools. Purdue, Lafayette College, and Oregon State College also received funds to establish scholarships in mechanical and civil engineering in honor of the engineers receiving the main awards. Information about the next annual competition, which will extend from June 1 to May 31, may be obtained from the foundation, Cleveland 17, Ohio.

The National Paraplegia Foundation has awarded a fellowship to Pei-chin Tang at the University of Washington for studies of the nerves controlling bladder action, and to Dominick P. Purpura at Harvard for work on the crossed phrenic phenomenon, under the supervision of Eugene Landis and Paul Chatfield.

Following closely upon the publication of the Rockefeller Foundation's Annual Report for 1950, which noted that \$11,247,964 had been disbursed in grants last year, came an announcement of grants for the third quarter of 1951 totaling \$844,000. Largest appropriation was \$275,000 for postdoctoral fellowships

in the natural and medical sciences, to be administered over a three-year period by the National Research Council. McGill University received \$214,800 for its newly established Institute of Islamic Studies. Other beneficiaries were the University of Amsterdam, University of Copenhagen, WHO, and the Council on Foreign Relations (New York).

Sigma Xi and the Scientific Research Society of America (Resa) have announced 29 research grants-in-aid for 1951, ranging in amount from \$100 to \$400, and totaling \$7,675. Approximately two thirds of the projects supported are in the varied fields of biology, and the recipients are scattered through the U. S. from Rice Institute to Carleton College, and from Oregon State College to Harvard. Two grants were made to foreign scientists—Hans Kienle, of Heidelberg Observatory, and Richard P. Dorf, of the University of Glasgow.

The Squibb Institute for Medical Research has given \$63,871 in grants and fellowships in the last six months of its fiscal year 1950-51, and \$254,925 for the first part of fiscal year 1951-52. A grant of \$40,000 went to R. Plato Schwartz, of the University of Rochester; \$22,000 was granted to Byron B. Clark, of Tufts College Medical School; and \$21,600 was given in partial support of Emory University's Department of Pharmacology. Research grants were given to scientists in the University of Lund and the University of Zurich, and a fellowship was awarded to José Carlos Pérez Avendaño, of Guatemala, for training in the U. S.

Miscellaneous

Chemicals wanted by the Registry of Rare Chemicals, 35 W. 33rd St., Chicago 16, Ill., include: vanadium disulfide; vanadium oxytrifluoride; ammonium pyrophosphate; rubidium chromic sulfate; sodium-*n*-hexadecyl sulfate; *p*-vinylidiphenyl; *m*-trichloromethylfluorobenzene; 1,2,3-triaminopropane; 1,1-dichloropropanone-2; 3-methylquinoline; 4-hydroxybutyrophene; 3-hydroxy-5-methylbenzoic acid; *o*-fluorobenzoic acid; *m*-ethylbenzaldehyde; eriodictin; ellagic acid; myoglobin; sedoheptulose; and propyl syringate.

The University of Cincinnati will hold a Homicide Seminar Dec. 3-7 for a limited number of police officers, in which all phases of scientific investigation of crime will be discussed in four daily eight-hour sessions, divided into 48 illustrated lectures. Frank R. Dutra, associate professor of forensic pathology in Kettering Laboratory and pathologist and deputy in the coroner's office, will be in charge.

A Symposium on Rheumatic Fever will be held in Minneapolis Nov. 29-Dec. 1 under the joint sponsorship of the University of Minnesota and the Minnesota Heart Association. T. D. Jones, G. Murphy, A. Dorfman, M. J. Shapiro, Ann G. Kuttner, A. H. Coons, C. H. Rammelkamp, F. F. Schwentker, and C. A. Stetson will be among the speakers. Lewis Thomas, Minnesota American Legion heart research professor, is in charge of the program.



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By FRANCIS D. MURNAGHAN, *Instituto Tecnológico de Aeronáutica, Brazil*. Written by a world-renowned authority, this is a new book in the Wiley APPLIED MATHEMATICS SERIES, I. S. Sokolnikoff, Editor. The essential feature of this volume is the consideration of squares and higher powers of the strain components in the theory of elasticity. This treatment permits the application of the theory to larger deformations and stresses than those allowed by the classical theory. Includes 115 exercises, with answers. 1951. 140 pages. \$4.00.

2. *the first new study on thinking in years*

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By GEORGE HUMPHREY, *Oxford University*. The author begins this study with a discussion of association and (what he considers the modern form of the same idea) the conditioned reflex. He summarizes these ideas carefully and then presents the arguments against considering them as a complete or nearly complete picture of the thought process. 1951. *In press*.

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CEREBRAL MECHANISMS IN BEHAVIOR

The Hixon Symposium. Edited by LLOYD A. JEFFRESS, *The University of Texas*. This significant book consists of six major papers, with discussions and a final evaluation, by experts in a number of allied fields. The major papers: The General and Logical Theory of Automata; The Problem of Serial Order in Behavior; Why the Mind is in the Head; Functional Differences between the Occipital and Temporal Lobes; Relational Determinism in Perception; Brain and Intelligence. 1951. Approx. 314 pages. Prob. \$6.00.

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By ALVA BENNETT, HELEN JUPNIK, HAROLD OSTERBERG, OSCAR W. RICHARDS, all with the *American Optical Company*. This important book combines the work of four scientists who have made outstanding contributions to the theory, instrumentation, and application of the phase microscope. It describes the phase microscope fully, including principles, adjustments, use, and various applications. 1951. 320 pages. \$7.50.

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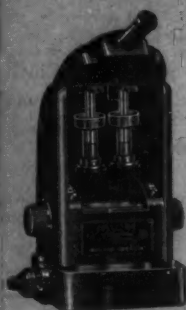
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Publications Received

- A Press Conference on the Exceptional Child.* Proc. 1951 Spring Conf. Child Research Clinic, Woods Schools. Langhorne, Pa.: Woods Schools, Mar. 1951.
- Exhibit Techniques.* Helen Miles Davis, Ed. Washington, D. C.: Science Service, 1951. 112 pp. \$2.00.
- Food and You.* Edmund Sigurd Nasset. Springfield, Ill.: Thomas, 1951. 92 pp. \$3.00.
- Fossil Mammals of Africa: Associated Jaws and Limb Bones of Limnopithecus Macinnesi.* No. 3. W. E. Le Gros Clark and D. P. Thomas. London: British Museum (Natural History), 1951. 27 pp. and 6 plates. 15s.
- Fundamentals of Semimicro Qualitative Analysis.* Rev. ed. Erwin B. Kelsey and Harold D. Dietrich. New York: Macmillan, 1951. 328 pp. \$4.00.
- Generating Stations: Economic Elements of Electrical Design.* 4th ed. Alfred H. Lovell. New York: McGraw-Hill, 1951. 431 pp. \$6.50.
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- Almost Sinusoidal Oscillations in Nonlinear Systems. Part 1: Introduction-Simultaneous Oscillations.* Johannes S. Schaffner. Bull. Ser. No. 395. May 1951. 60¢.
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- Radiant Baseboard Heating and Effects of Reduced Thermostat Setting and Open Bedroom Windows at Night.* Warren S. Harris and Robert H. Weigel. Bull. Ser. No. 391. Urbana: Univ. Illinois. July 1951. 70¢.
- Report of the Governor's Study Commission on the Deviated Criminal Sex Offender.* State of Michigan: Commission on the Deviated Criminal Sex Offender. 1951.
- The Origin, Variation, Immunity and Breeding of Cultivated Plants.* Vol. 13, No. 1/6. N. I. Vavilov. Trans. from the Russian by K. Starr Chester. Waltham, Mass.: Chronica Botanica, 1951. vii + 366 pp. Illus. \$7.50.
- Tracerlab, Catalog C.* Boston: Tracerlab. Oct. 1951.

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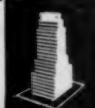
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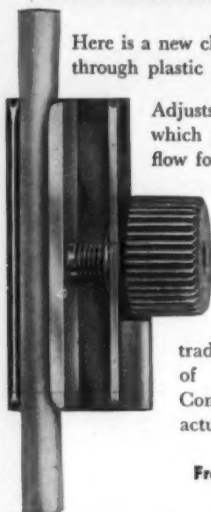
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- Nov. 26-Dec. 1. Exposition of Chemical Industries. Grand Central Palace, New York.
- Nov. 27-28. American Institute of Architects and Atomic Energy Commission Conference on Laboratory Design for Handling Radioactive Materials. National Academy of Sciences, Washington.
- Nov. 28-30. Scientific Apparatus Makers Association (Midyear). Hotel New Yorker, New York.
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- Nov. 30. Scientific Research Society of America (RESA). National Academy of Sciences, Washington, D. C.
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- Dec. 6. Society of Cosmetic Chemists (Annual). Biltmore Hotel, New York.
- Dec. 6-8. American Chemical Society (Southwest Regional). Austin, Texas.
- Dec. 7-8. Way of Science Conference (Annual). Roosevelt College, Chicago.
- Dec. 9-13. Entomological Society of America, American Phytopathological Society, and the Potato Association. Netherland Plaza Hotel, Cincinnati.
- Dec. 10-11. Southern Psychiatric Association (Annual). Carolina Inn, Pinehurst, N. C.
- Dec. 11-19. International Congress on Mental Health. Mexico City, D. F.
- Dec. 14-15. Association for Research in Nervous and Mental Disease. Roosevelt Hotel, New York.
- Dec. 20. American Society of Perfumers. Advertising Club, New York.
- Dec. 26-28. American Mathematical Society. Brown University, Providence, R. I.
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